

Integration of Digital Games in Learning and E-Learning Environments: Connecting Experiences and Context

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Abstract Researchers and educational practitioners are increasingly turning their attention towards the effects of the use of digital games for learning. Many games satisfy the basic requirements of learning environments and can support the teaching and learning process. However, an in-depth understanding is needed of the different possibilities that digital games can provide in order to successfully integrate educational methods and game design. The main goal of this chapter is to analyse how the use of digital games could be integrated into learning with special emphasis on the importance of games for connecting experiences, context and learning. The chapter starts with a description of the different terminology used in the field of game-based learning. Then, we provide a summary of the main results obtained by researchers regarding the potential of digital games to support learning and we analyse the main directions for using game-based learning.

Keywords Game-based learning · E-Learning · Gamification · Digital games · Serious games · Integration of digital games for learning · Effects of digital games in learning · Players

Introduction

The use of electronic games in education has experienced a significant evolution. Initially, electronic games were developed in the entertainment market without considering their impact on learning. However, since the 1980s several studies have identified the potential of games for learning (e.g., Gee 2003; Kafai and Ching 1996; Malone 1981; Prensky 2001; Squire 2002). The author's main argument is that some commercial video games, especially strategy games, simulations and role-playing games, are based on well-developed theories of learning in order to engage players and teach them how to play the game (Gee 2003). Many suggest that by situating players in these virtual worlds, where they can move and act freely,

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the games can promote problem solving, goal-oriented behaviour, engagement and motivation (Prensky 2010; Shaffer et al. 2005). Others argue that games help to develop strategic thinking, group decision-making and higher cognitive skills (Arnseth 2006; Clark et al. 2014; de Freitas 2006). Some researchers claim that games permit constructive, situated and experiential learning, which is enhanced by active experimentation and immersion in the game (Squire 2008; Hainey et al. 2011). Generally, it seems that games could be particularly useful for generating a deeper understanding of complex settings (Gros 2007), mainly when dealing with multifaceted variables.

In spite of this potential, some studies also report problems with the use of digital games for learning (Egenfeldt-Nielsen 2006; Ferdig 2007). Among the most notable issues are the lack of acceptance of games as an educational tool, the problem of integration into formal schooling, the tension between gameplay and learning objectives, and the problem of transferring knowledge gained in video games to the real-world.

The findings of games studies are conflicting and even contradictory due to the broad nature of the studies. However, interest in this topic is increasing, thanks to the continuous expansion of this technology, not only in schools and colleges, but also in universities (New Media Consortium [NMC] 2012).

Researchers and educational practitioners are increasingly turning their attention towards different types of games, such as epistemic games, serious games, multiplayer games and social games. The growth of online gaming may also produce more learning experiences connecting learning at work, home and formal learning institutions.

The aim of this chapter is to analyse how the use of digital games could be integrated into learning with special emphasis on the importance of games for connecting experiences, context and learning. The chapter is divided into four sections. Firstly, we will establish a distinction between different concepts related to game-based learning. Secondly, we will summarise the main results obtained by researchers regarding the potential of digital games to support learning. Next we will describe some challenges to integrating digital games into e-learning and finally, we will analyse the main directions for using game-based learning.

From Video Games to Gamification

There is a rich vocabulary around the use of digital games. In this section, we discuss the main terminology to clarify the evolution of electronic games and the different types and applications.

The general label of ‘video game’ or ‘digital game’ can be applied to many different types of games. We can identify multiple genres or categories of computer games including, but not limited to, action games, adventure games, simulation games, sports games, strategic games, puzzle games and role-play games.

It is possible to categorise the games based on many factors such as method of gameplay, content, type of goals, style or interactivity. However, as technology

continues to evolve, digital games have developed into ever more complex games which have enhanced some possibilities and have added new ways of playing and new types of platforms. Some genres are combinations of others. For instance, most sports games, like the FIFA Football series, contain information needed to manage a team and combine simulation with characteristics of strategy games. What is relevant is that most of the well-known games (with their constantly updated versions) contain features of simulation and adventure. Elsewhere, strategy is also present in most historical simulations, such as *Age of Empire*, *Civilization*, and *Imperium*. In other words, there is a tendency to produce games that provide complex environments in which content, skills and attitudes play an important role during the game.

The way to play has also changed. Most of the video games created in the last decade are played individually. However, video games are increasingly being designed for multiple players. We can distinguish among: *online games*, *massive multiplayer online games* (MMOGs) and *social games*.

Online games are video games played over a computer network (Rollings and Adams 2006). The expansion of online gaming is based on the overall expansion of computer networks and ranges from simple text-based environments to games incorporating graphics and virtual worlds populated by many players simultaneously.

MMOGs provide a common online platform that draws players together from all over the world and they have come to dominate the digital entertainment industry (Magnussen and Misfeldt 2004). These games are an evolution of games formerly known as Multi-User Dungeon or Domain or Dimension (MUDs) and are referred to as ‘virtual worlds’ as they are not simply games in the traditional rules-based sense, but rather open-ended narratives where players are largely free to do as they please. A central element in multiplayer games is that the interaction enables players to communicate and collaborate in the game sessions.

Recently we have also seen social games connected with specific social networks like Facebook. According to Revuelta and Bernabé (2012), not all social games are the same. Some video games use the social network only as a distribution medium. In other cases, the social network facilitates finding other players at a given time (e.g., poker games or UNO) and some games use the social network in the different layers of communication that this provides. The game can be played among the ‘friends’ who have accepted and, at the same time, globally among all network users. A good example of this type of game is *Farmville*. This game uses Facebook to offer something that would otherwise be truly unachievable in any other platform.

The production of games for mobile phones and tablets has also increased the social dimension. According to Klopfer, “mobile games allows the creation of flexible and ever-changing complex games, promotes the ability to adapt games to a number of different styles such as competition and collaboration, creates situations in which players learn specialised communication, and produces a social dynamic in which players need to construct arguments and strategies with and against other players” (2008, p. 38).

In many products—like *Civilization*, *Zoo Tycoon*, *Rise of Nations* and *The Sims*—models and simulations are an integral part of the game. In all these examples the game stresses first- and third-person player experiences. In some cases,

the whole game is a model of the practice and culture of the particular topic. For instance, in Tony Hawk's Pro Skater players can design their own skaters, clothes, boards, skate parks and so on. They build a mode and interact with a set of more abstract models of environments that help to build a more realistic context.

According to Van Eck (2006), there are three main approaches to creating games that provide cognitive growth for the gamer. These three approaches are: building games from scratch created by the educator, creating games from scratch by the students, and integrating commercial off-the-shelf (COTS) products.

The use of COTS games in the classroom means that teachers have to integrate commercial games. In this case, it requires teachers to have adequate self-efficacy concerning the use of these games and their technology. Most COTS do not have an educational goal. However, a number of successful uses of COTS in formal education settings have been documented (Ulicsak and Williamson 2010; Sandford et al. 2007). One example is Blunt's adoption of COTS management simulation video games (Industry Giant II, Zapitalism and Virtual U) for business studies (Blunt 2009). Other COTS games already being used in the classroom include Civilization (history), Age of Empires II (history), CSI (forensics and criminal justice), The Sims 2 (building complex social relationships), Rollercoaster Tycoon (engineering and business management), and SimCity 4 (civil engineering and government). For some of these, there is a clear match between the game's explicit content and the classroom subject; for others there is a match between the aims and skills involved in the course of study and the game's underlying strategies and gameplay (Sandford et al. 2007).

In recent years, there has been a resurgence of educational games due to the rise of the *serious games* movement. Michael and Chen consider serious games are those "in which education (in its various forms) is the primary goal, rather than entertainment" (2006, p. 16). These serious games may be differentiated from educational games because of their focus on the post-secondary market and training. This growing interest in serious games is also linked to economic considerations because companies need to instruct employees and individuals need to update or innovate their skills from a lifelong learning perspective. In addition, serious games are also entertaining and this should encourage people to spend their free time on educational activities. The production of serious games is especially important in the field of business/management, healthcare and military training.

Epistemic games are another interesting type of game designed primarily for training professional skills. The main goal of epistemic games (Shaffer and Gee 2006) is to help players learn to think like professionals. This concept is based on the idea of 'epistemic frames'—the way in which a profession or other community of practice thinks and works—and entails a situated and action-based form of learning built around the ways in which professionals develop these epistemic frames. Shaffer (2008) argues that this approach makes it possible to create epistemic games in which subjects learn to work as doctors, lawyers, architects, engineers, journalists and other valued professionals; in this way they develop the skills, habits and concepts of a post-industrial society. These games help them to develop ways of

thinking and knowing that are valued in the world, giving them a way to imagine the future person they might someday become.

Game Based Learning (GBL) refers to the use of video games to support teaching and learning. “It encompasses the use of both games designed expressly for fulfilling learning objectives (educational games) and ‘mainstream games’—i.e., those games that are developed for fun when used to pursue learning objectives” (Kirriemuir and McFarlane 2003, p. 19).

Due to the success of games used for learning, some didactical proposals are introducing the concept of gamification. Kapp describes gamification as “the careful and considered application of game thinking to solving problems and encouraging learning using all the elements of games that are appropriate” (2012, p. 12). The main idea is to use the mechanics and game-design techniques to enhance non-game scenarios (Zichermann and Cunningham 2011) to increase the learner’s motivation and engagement. The idea is to introduce something normally used in a game, such as incentives, immediate feedback and rewards, into an online subject or into the classroom. For instance, in e-learning it is possible to introduce a specific quest with a gamified formative assessment. Game-based learning and gamification often overlap. In a gamified classroom, it is possible to use games throughout the unit or it is possible to create a gamified unit using a serious game. In summary, game-based learning can be a small component of the learning process or a descriptor of the entire pedagogical model. Gamification, on the other hand, refers to changing the entire model of instruction to be a game or game-like. In both cases the main goal is the same: student engagement. And, in both cases, there must be a paradigm shift in the educator from ‘sage of the stage’ to ‘guide on the side’ (King 1993). Regardless of which method or pedagogy is employed in the classroom, games provide an opportunity for students who may not have been fully engaged in learning to go on to achieve success.

The use of games has been shown to be successful for encouraging student participation and maintaining contribution. Developments in gamification, serious computer games, and game-based learning are becoming important for virtual learning environments (VLEs).

Foundation of Digital Games for Learning

In the 1980s, computer games were presented as a potential learning tool based on the idea that games improve learners’ motivation. According to Ke (2009), most of the literature on the use of digital games was based on authors’ opinions regarding the potential of instructional games or proposals about how games could be developed to be instructionally sound. During that period of time, few articles documented the effectiveness of instructional games, much of the work was descriptive (Dempsey et al. 1996) and the real use of games for learning was very scarce. However, in the last decade, the amount of research into game-based learning has increased considerably (Ke 2009; O’Neil et al. 2005; Hwang and Wu 2012;

Mayer 2012). Currently, we can find studies in a variety of learning settings: elementary education, secondary education, adult education, business management, military and healthcare. Some studies focus on general problem solving and skills development (Hwang and Wu 2012), and there are also an important number of studies based on the use of games in learning subject areas such as mathematics, language arts, reading, physics, health, natural sciences and science.

Despite the diversity and scope of the studies, this is still an area with considerable weaknesses. Mayer (2012) considers that there is an increase in publications, methods, tools and findings, but there is not a methodology for digital games research and most of the experiments are very short and do not provide longitudinal data. According to Hwang and Wu (2012), most research is mainly focused on the investigation of students' motivations, perceptions and attitudes toward digital games.

The central consideration supporting the use of digital games for learning is based on the idea that video games provide a good learning environment in accordance with the main principles of active learning (Gee 2003; Kafai and Ching 1996; Malone 1981; Prensky 2001; Squire 2008). Players have to understand the internal design and the social practice that determine the activity of the game. Along these lines, Gee (2003) has proposed 36 learning principles that provide a comprehensive account of the potential of games for creating engaging learning, problem solving skills, cooperation and practical participation. In summary, "games are powerful contexts for learning because they make it possible to create virtual worlds, and because acting in such worlds makes it possible to develop the situated understandings, effective social practices, powerful identity, shared values, and ways of thinking of important communities of practice" (Shaffer and Clinton 2006, p. 7).

Some studies intended to explore whether digital games play any role in supporting educational goals. The analysis of the available studies by subject matter reveals that some knowledge domains are particularly suited to gaming, such as mathematics, physics and language arts (Hays 2005; Ke 2009). Researchers also explore how game-based learning activities should be organised. For instance, Sandford et al. (2007) report that teachers' facilitation plays an important role in an effective use of instructional games in the classroom. These studies consider that the investigation into computer games for learning should focus on how games can be aligned with pedagogical strategies or learning conditions to be beneficial (Hwang and Wu 2012).

Few studies analyse the learner characteristics; only gender has been examined (Dempsey et al. 1996; Haynes 2000; Hays 2005). However, if the use of games can support personalised learning, it is important to analyse the profile of players/learners. Games should present players with challenges that are matched to their skill level in order to maximise engagement (Kiili 2005). A game has to be able to provide the opportunity for appropriate guidance or collaboration in order to help players meet the next challenge. "The key is to set the level of difficulty at the point where the learner needs to stretch a bit and can accomplish the task with moderate support" (Jalongo 2007, p. 401).

Generally, instructional computer games seem to facilitate motivation and engagement across different learner groups and learning situations. This finding is in agreement with Vogel et al.'s (2006) quantitative meta-analysis conclusion that the effect size of games versus traditional teaching methods is highly reliable for attitude outcomes. "Games contain the pieces necessary to engage students and help them enter a state of flow where they are fully immersed in their learning environment... and focused on the activity they are involved in" (McClarty et al. 2012, p. 14). When complete attention is devoted to the game, a player may lose track of time and not notice other distractions. Games support many of the components of flow (Csikszentmihalyi and Nakamura 1979) such as clear goals, direct and immediate feedback, balance between ability level and challenge, and sense of control. These components can increase student engagement, and student engagement is strongly associated with student achievement (Shute et al. 2009).

Another contribution offered by games is the support of problem solving activities. Some authors consider this contribution intrinsic to gameplay (Gee 2007; Kiili 2007; Hung and Van Eck 2010). However, some designers consider it important to establish dialogue and collaboration between instructional designers and game developers to gain a better idea of what types of gameplay will most appropriately afford given learning goals and objectives (Hung and Van Eck 2010). Similar efforts have been made with serious games by mapping identifiable steps or events in game interaction against general learning activity frameworks. One reference adopted for interpreting game pedagogy is Bloom's taxonomy and Gagné's nine events of instruction (Hung and Van Eck 2010).

Several studies have explored whether these games play a role in supporting current educational objectives. In most cases (de Freitas and Oliver 2006; Gros 2007; Gros and Garrido 2008; Sandford et al. 2006), the most common obstacle facing the use of digital games in schools is identified by the teachers and refers to some practical difficulties. They identify the use of the games as positive learning experiences, but mention a number of problems and limitations: the lack of time available to familiarise themselves with the game, the problem of selecting the game and the difficulty in persuading other colleagues of the benefits, and the lack of educational games to support the curriculum. Assisting teachers with game-based learning may therefore require more flexibility in terms of lesson duration, as well as measures to ensure adequate time for lesson preparation and good technical support. Teachers require guidelines and frameworks for supporting innovative practice, "achievement of educational objectives was more dependent upon a teacher's knowledge of the curriculum...than it was on their ability with the game" (Sandford et al. 2006, p. 3). In summary, the teacher played a central role in scaffolding and supporting students' learning.

The Use of Digital Games in E-Learning

Games can be used in traditional face-to-face classrooms, but there is also a very promising use of games in virtual learning environments. In this section, we describe some of the main challenges and problems of using digital games for e-learning.

E-learning can be used as a general term that includes all forms of educational technology in learning and teaching. However, in this case we use the term as the modality of asynchronous teaching and learning. E-learning describes education that occurs in a distance education mode using the web as the sole medium for all student learning and contact. The value of e-learning lies in its ability to train anyone, anytime, anywhere. E-learning or blended learning (the combination of face-to-face with virtual activities) must provide a complete environment to support students' learning processes.

Traditional models of e-learning have focused on content as the most important element of the courses. However, the evolution of technology is fundamental in the evolution of e-learning. Innovation in ICT is providing new ways to deliver online learning. E-learning can be viewed as "an innovative approach for delivering well-designed, learner-centred, interactive and facilitated learning environments to anyone, anyplace, anytime by utilising the attributes and resources of various digital technologies along with other forms of learning materials suited for open, flexible and distributed learning environments" (Khan 2005, p. 33).

Bates (2011) considers that e-learning allows the development of important skills for the knowledge society: skills related to the use of technology, independent study, searching for information, problem solving, collaborative learning, personalisation and lifelong learning. However, we can find a lot of games for e-learning based on a behaviourist approach of learning and mainly focused on the transmission of content and not on complex learning activities. In fact, there are many companies and some open software that provide templates to produce e-learning games based on training games, quizzes and polls.

Personalisation in e-learning is an important challenge that can be achieved by tapping into the interactive potential of games. The most obvious type of adaptation in video games is the inclusion of different levels of difficulty; trying to adjust the challenge to different levels of skill. However, the potential is even greater thanks to the high interactivity of games, which can be used to implement much more fine-grained adaptation mechanisms. Some advanced games can even carry out this adaptation transparently to the user. For example, the *Left4Dead*TM saga <<http://www.valvesoftware.com/games/l4d2.html>> includes an artificial intelligence engine that customises elements like pathways through the game world, enemy populations and also the game atmosphere and environment through adaptive music, sound and visual effects according to the player's style of play.

An important dimension of digital games is connecting the game worlds to real worlds, either by adopting advanced technologies or by building communities of practice. With proper technology and storylines, digital games could extend learning

from the virtual game world to the real-world, providing students with more authentic experiences. Squire and Klopfer (2007) and Rosenbaum et al. (2006) illustrate examples of using augmented reality technology to explore the real-world through digital games.

The integration of video games or 3D immersive virtual worlds into e-learning is not new. However, implementing communication between the game and the virtual learning environment (VLE) is not always easy.

A VLE is an e-learning education system based on the web that provides a virtual space equivalent to classes. It contains the content of the course, homework, grades, assessments, social space where students and teacher can interact through threaded discussions, social tools and other external resources, such as website links.

In the last decade, there has been much debate about the benefits of using VLEs because it is difficult to create standards for integrating other resources developed outside the virtual learning environment. This is mainly the situation related to the use of digital games.

In order to use digital games for learning purposes, games and VLEs need to establish active and bidirectional communication to support the exchange of data. Current e-learning standards were not designed to support this kind of communication. Some standards address the communication between VLEs and content (e.g., Sharable Content Object Reference Model [SCORM]) or the adaptation of the learning flow, but we still need to deal with the current diversity of VLEs and with a lack of specific standardisation support for the peculiarities of game-based learning. According to Moreno-Ger et al. (2009), a game developer who wants to integrate a game into a VLE must identify which standard/specification will be used in the VLE to store the data and how the games will exchange information with the VLE. Given the current situation, with diverse standards available, this does not guarantee the full interoperability of the contents, leaving the investment unprotected.

The standardisation of learning games does not seem to be very systematically developed. Livingstone and Hollins (2010) report that various technical standards for gaming can be used, such as different standards in 3D technologies, browser languages and also different kinds of multimedia standards like Flash or, more recently, HTML5 for use with mobile devices. Interactive storytelling has a specific relevance to the design of learning games and the IMS-LD (International Management System-Learning Design) standard has been shown to have this potential.

Kelle et al. (2011b, p. 527) describe two design methodologies (Fig. 1), starting the design cycle from the gaming or the e-learning standards perspective.

By starting the design from the side of learning, it is possible to model the educational process and then iteratively integrate game elements into the instructional design. From the game perspective, the methodology links game elements with learning activities and outcomes. According to Kelle et al. (2011a), both models have limitations and the ideal situation would be to have both directions in one learning game.

Despite the fact that the standards implemented by VLEs are diverse, a small number of these are starting to dominate the market share (for instance, Moodle,

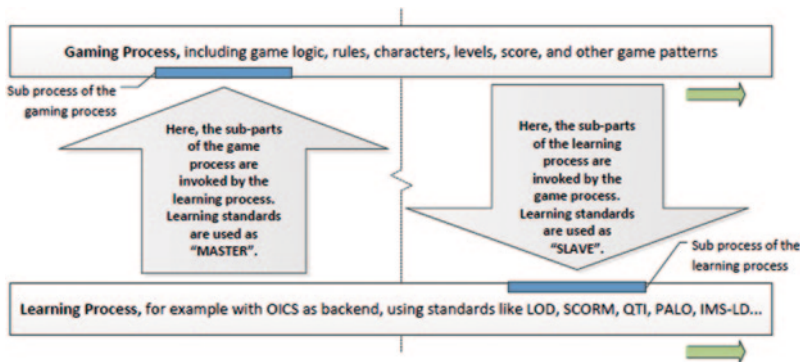


Fig. 1 The use of e-learning standards

Blackboard) and consequently it is more feasible for developers to develop the games for specific VLEs.

We have discussed some aspects related the technological issues that must be taken into account in order to integrate digital games into e-learning. However, the main challenge is not technical but is largely a methodological issue. In the next section, we will discuss how to integrate digital games for learning.

Pedagogical Challenge for the Integration of Digital Games into Learning

The way that digital games are implemented for training is strongly influenced by the evolution of technology. One of the most important features in the advance of digital games is the interaction between the game and the player. Although some games still use the keyboard, many others require a device to be pointed at a screen (Nintendo's Wii), direct interaction with full-body motion (Kinect) or using finger movements on the screen. A number of technologies are on the horizon to provide an even more immersive environment than is possible today (such as 3D and augmented reality). Haptic computing, which adds the sense of touch to the simulated or virtual environment, is already being used in medical training. Nintendo's Wii platform has brought awareness of haptics to the consumer market, opening the door to new learning design and gaming innovations. For this reason, the application of video games in training is very varied (e.g., social science, physics, mathematics, sport), and we cannot establish a unique methodological approach for game-based learning. A systematic meta-analysis of the uses of digital games for learning (Clark et al. 2014) reveal that games with augmented designs for learning improve learning relative to standard versions. This finding highlights the importance of design in learning outcomes. Comparing multiple game-based interventions to one another

indicate that certain types of game structures may be more effective for certain types of outcomes. It is very important the design beyond simple choice of medium when discussing the affordances of digital games for learning. Although this conclusion is quite obvious, the role of design does not appear in debates over whether digital games are “better” or “worse” than traditional instruction. For this reason, it is very important to consider this finding when interpreting the media-comparison analyses. In this section, we will describe the main elements to take into account when designing the use of digital games in formal education.

Despite the benefits of digital games mentioned previously, their integration into formal education is scarce and different problems have been identified. First and most notably, there is a lack of acceptance of games as educational tools among the majority of educators (Egenfeldt-Nielsen 2006; Felicia 2009; Hwang and Wu 2012; Wastiau et al. 2009). Some teachers perceive the use of games as a leisure time activity with no pedagogic value. In addition, teachers have problems integrating games into a regular classroom. There are many products and it is difficult for them to select the appropriate game for each educational purpose. For this reason, some associations are developing networks of teachers to promote the use of digital games by providing examples and criteria for selecting games (de Freitas et al. 2012; Wagner 2012).

Another important problem to take into account is that playing in an informal situation is not the same as playing in a formal setting. For instance, a meta-analysis of the cognitive and motivational effects of serious games reveals that “between leisure computer games and serious games is that the former are chosen by the players and played whenever and for as long as they want, whereas the type of game that is used and the playing time are generally defined by the curriculum in the case of serious games. Within the instructional context, it is possible that the lack of control on these decisions has attenuated the motivation appeal of serious games” (Wouters et al. 2013, p. 260).

The main goal for a player is to have fun and not to learn. For this reason, implementing games for learning purposes requires designing activities in which the game is part of a learning scenario. Learning does not just end with the game.

These problems are not only related to primary and secondary education. The Horizon Report for Higher Education (NMC 2011, 2012) mentions the use of serious games as a promising area to support learning in universities and identifies the time-to-adoption for games and gamification as 2–3 years. However, the real adoption and institutional implementation of games in post-secondary education is still at an experimental stage—we can find some isolated experiences but there is no systematic implementation (Epper et al. 2012). De Freitas and Oliver (2006) consider that there are four aspects to take into account when planning to use digital games for learning: learner modelling and profiling, the role of pedagogic approaches for supporting learning (e.g., associative, cognitive and situated), the representation of the game itself (how high the levels of fidelity need to be, how interactive the game is and how immersive the game might be), and the context within which learning takes place (e.g., discipline and setting).

Table 1 Game elements grouped according to the four-dimensional work (van Staaldunin and de Freitas 2011)

<i>Learner Specifics</i>	<i>Pedagogy</i>
Challenge	Adaptation
Conflict	Assessment/Feedback
Progress	Debriefing/Evaluation
	Instructions/Help/Hints
	Safety
<i>Representation</i>	<i>Context</i>
Action-Domain Link	Fantasy
Control	Goals/Objectives
Interaction (Equipment)	Language/Communication
Interaction (Interpersonal)	Mystery
Interaction (Social)	Pieces or Players
Location	Player Composition
Problem–Learner Link	Rules
Representation	Theme
Sensory Stimuli	

The elements of the games detailed above are quite varied; however, they all fit into one of the four mentioned categories: learner, context, pedagogy and representation. For this reason, van Staaldunin and de Freitas (2011) have proposed joining up the elements (see Table 1).

Hanghøj and Brund (2010, p. 116) state: “Game-based teaching can be understood as a complex series of pedagogical choices, practices and meaning-making processes, which can be analysed through the complimentary notions of teacher roles, game modalities, and positionings”. To a certain degree this teacher-centred standpoint can be seen as an alternative, or complimentary, take on the four-dimensional model. The proposal (see Fig. 2) identifies a repertoire of different roles that



Fig. 2 The relationship between different game-based teaching roles (Hanghøj and Brund 2010)

teachers assume throughout the process, namely that of instructor, playmaker, guide and explorer. These correspond to different phases in the deployment process and can be mapped onto axes according to the type of knowledge (curricular/game) and perspective (outsider/participant) involved (Magnussen and Hanghøj 2010). This proposal provides a general framework for gaining a more concrete understanding of game-based learning dynamics from the educator's perspective.

It seems clear that to successfully integrate digital games it is essential to align the direction of learning, instruction and assessment. The design of the game must fit with the pedagogical design and the content area or the intended learning outcomes. This is most evident in the use of commercial video games as they do not have an educational purpose and, therefore, it is necessary to plan how to integrate the resource. It is easier to integrate serious games that have been created for educational purposes. Moreover, debriefing is critical for using games in education as it provides the connection between learning in the game and applying those skills to other contexts (Ash 2011; Gros 2007). Teachers can facilitate the transfer of skills by leading pre- and post-game discussions, which connect the game with other things students are learning in class.

The ultimate aim of integrating games into learning can be very varied. We propose six important directions based on the predominant reasons for integrating games: to teach twenty-first century skills, to improve motivation, to teach content, to improve learning experiences, for authentic assessment, and for design and creativity.

Games to Teach Twenty-First Century Skills

There is a growing awareness that teaching twenty-first century skills “frequently requires exposing learners to well-designed complex tasks, affording them the ability to interact with other learners and trained professionals, and providing them with appropriate diagnostic feedback that is seamlessly integrated into the learning experience” (Rupp et al. 2010, p. 4). Consequently, the use of digital games is closely related to skills like collaboration, innovation, production and design. For this reason, digital games are frequently cited as important mechanisms for teaching twenty-first century skills because they can accommodate a wide variety of learning styles within a complex decision-making context (Squire 2006).

Games to Improve Motivation

A year-long pan-European study that included over 500 teachers found that the great majority of the teachers surveyed confirmed “motivation is significantly greater when computer games are integrated into the educational process” (Joyce et al. 2009, p. 11). Most games provide clear goals, tasks and challenges, and reinforce feedback, which are important elements for improving motivation. For this reason, games are often used as a starting point for improving motivation.

Games to Teach Content

Commercial games or serious games can be used to teach some specific content in the curriculum. In many cases, the main challenge is the integration rather than the use of the game for learning, and to focus on solving complex problems. Most video games provide complex learning environments in which players have to be able to control many different variables, take decisions, establish strategies and constantly compare the effects of their actions in the system.

Games to Improve Learning Experiences

Kiili (2005) has developed an experiential gaming model to link gameplay with experiential learning in order to facilitate flow experience. Experiential learning describes the acquisition of knowledge in a learning cycle with four successive stages (Kolb 1984): concrete experience, reflective observation, abstract conceptualisation, and feedback or active experimentation. The core of Kolb's four-stage model is a simple description of the learning cycle which shows how experience is translated by reflection into concepts, which in turn are used as a guide to feedback or active experimentation and planning new experiences or creating alternative methods of action. In this way it helps learners to understand the process of acquiring concepts, skills and attitudes from their own point of view.

The design cycle (Fig. 3) describes the main phases of game design and works as a guideline in the design process. The design process is presented abstractly because it may vary among the different game genres. The model emphasises the importance of considering several flow antecedents in educational game design: challenges matched to the skill level of a player, clear goals, unambiguous feedback, a sense of control, playability, gamefulness, focused attention and a frame story (Kiili 2006).

Using this approach allows us to highlight a very important aspect: the gaming experience is not the same in a formal context as it is outside the school setting. Including games in a learning context aims to leverage the advantages of digital game design to enhance learning. It is important to stress that the pedagogical exploitation of video games involves bringing the game into the classroom under the guidance of teachers, who must work to make the experience of playing a reflective experience.

Games for Assessment

It is important to note that video games are inherently assessments. Assessment occurs naturally in a game due to the immediate feedback. Players make progress or they do not; they advance to the next level or try again. According to Ash (2012), the challenge lies in assessing the appropriate knowledge, skills or abilities.

The opportunity for games to be used as assessments is greatly enhanced because of their capacity to collect data about students. Shute (2013) refers to this embedded gathering of information about players as "stealth assessment", an evidence-based

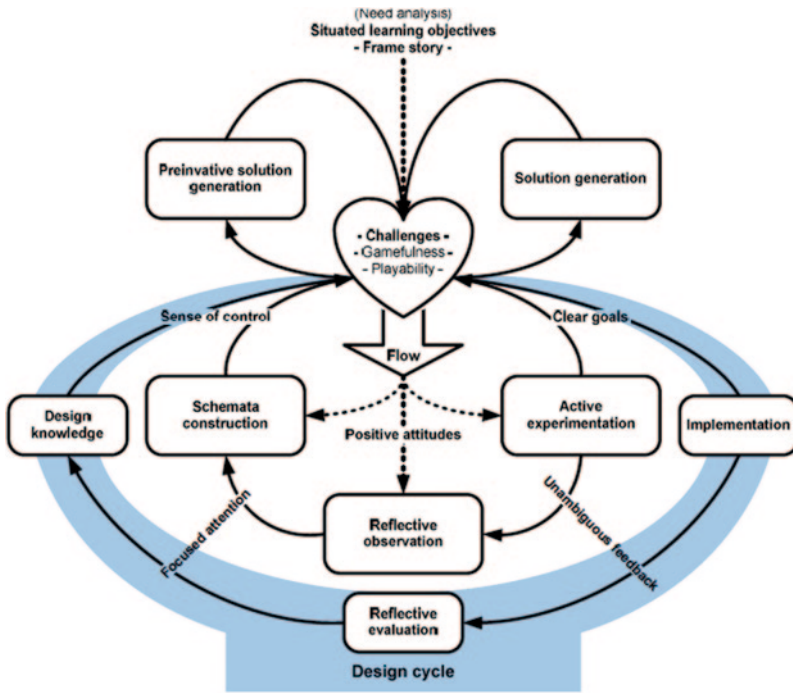


Fig. 3 Experiential gaming model (Kiili 2005, p. 18)

process by which assessment can be integrated directly into learning environments. Moreover, Shute and Kim (2011) demonstrate how assessments can be embedded within a commercial game to examine the learning of educationally relevant knowledge and skills.

Games for Design and Creativity

Another approach to using game-based learning is to ask the students themselves to design digital games to teach others. Prensky (2008) states that students are capable of game design because they are the ones that are closely related to the learning subjects and who understand most about the power of games for learning. By learning through designing games, students can increase their understanding of subject concepts, and enhance their general problem solving abilities and creativity.

This approach was very difficult to apply in the past; however, the software to produce games has improved and now provides easy tools that can be used with students. For instance, GameMaker¹ and Scratch² do not require professional programming abilities and support the creation of video games.

¹ <http://www.yoyogames.com/studio>.

² <http://scratch.mit.edu>.

Conclusion

This chapter has reviewed the current use and integration of digital games in education and has analysed the foundations of game-based learning.

The use of digital games has been shown to be successful for encouraging student participation. Possibly what is most important about digital games is the combination of motivation, engagement, adaptivity, simulation, collaboration and data collection.

Developments in gamification, serious computer games and game-based learning are becoming important for virtual learning environments (VLEs). However, the main challenge is to improve the acceptance of games as an educational tool and increase their real integration.

General perceptions of the usefulness of games to support learning are certain to improve over the next few years, as the generations learning with games in the classroom reach tertiary education and as teachers receive tools and guidance for developing their own game-based learning activities with groups of learners with different skills, levels and competencies.

We believe that research should no longer focus on whether games may be used for learning, but instead should prioritise how games can be best used for learning.

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