

The place of game-based learning in an age of austerity

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Abstract: Digital games have the potential to create active and engaging environments for learning, supporting problem-solving, communication and group activities, as well as providing a forum for practice and learning through failure. The use of game techniques such as gradually increasing levels of difficulty and contextual feedback support learning, and they can motivate users, using challenges and rewards, competition and mystery. Above all, computer games provide safe spaces in which learners can play, explore, experiment, and have fun. However, finding appropriate games for specific educational contexts is often problematic. Commercial entertainment games are designed for enjoyment, and may not map closely to desired learning outcomes, and the majority of educators do not have the time or specialist expertise to create their own games. Computer games are expensive to purchase or produce, and learners, particularly busy adult learners, need to be convinced of their effectiveness. So while there are many theoretical benefits to the use of computer games for learning, it given the increasing economic constraints in education, their use may simply not be practical.

This paper presents three alternative ways in which the theory and practice of computer games can be applied to education, without the expense. First, the option of developing simple and cost-effective games with low technical specifications, such as alternate reality games, or using virtual worlds or one of the growing number of accessible game-builder toolkits to create educational games, will be explored. Second, learning *from* games rather than *with* them is discussed, examining game techniques that naturally enhance learning, and embedding those elements in traditional teaching practices. Third, the paper presents the option of giving learners agency as game creators rather than simply players, so that it becomes the process, not the product, which facilitates learning. The advantages and drawbacks of each approach are discussed, looking at both practical and pedagogic issues. In this way, the paper aims to offer alternative ways of thinking about the potential of digital games for learning, and present possible solutions to the increasing financial constraints that face the field.

Keywords: budget constraints, alternative approaches, game development, theory

1 Introduction

There is a great deal of evidence that digital games have the potential to support learning in a variety of contexts, from primary and secondary schools (e.g. Bottino & Ott, 2006; Suh et al, 2010; Watson, Mong & Harris, 2011), to universities (e.g. Connolly, Stansfield & Hainey, 2007; Ebner & Holzinger, 2007; Whitton & Hollins, 2008), adult education (e.g. Kambouri et al, 2006) and workplace contexts such as military training (Fong, 2004) and medical practice (Mann et al, 2002). Digital games have the can create active and experiential constructivist learning environments, which support problem-solving and collaboration, and create a forum for practice and learning through failure. Scaffolding through increasingly-difficult levels allows learners to gradually take more control over their learning and immediate, contextual feedback supports the transition from novice to expert. Games can engage different users in different ways, using a range of mechanics such as compelling challenges and rewards that demand puzzle-solving or creation of artefacts, competition, stories, working with others, and supporting the human urge to complete sets (Whitton, 2009). Above all, games can provide safe playful spaces in which learners can make mistakes in a safe environment, free from external consequences; in which failure is a recognised and accepted part of the process. Players can reflect on those mistakes, experiment, explore, build things, and create their own communities and mythologies.

Despite the many pedagogic and motivational benefits of using computer games in learning and teaching, their use is problematic in many ways. A major barrier is cost, both in terms of the monetary expense of purchasing games and associated hardware, and also in terms of time for educators to develop the skills to evaluate or create games and the activities to support them. There are also issues of the acceptability of games in formal educational contexts, and practitioners need to be convinced of the potential of the medium as well as its limitations and be confident in the use of games (Becker, 2007). In many educational settings, particularly in Higher Education, where topics become increasingly niche, commercial games – for entertainment or education – are limited because of the small potential market. Designing and developing original computer games is beyond the expertise of most teachers and lecturers, and even when a good game design idea is used as a starting point, educators often lack the technical expertise is often lacking to be able to translate the design into a working game. While excellent examples of bespoke educational game developments

do exist, they are typically in technical areas such as engineering or computing, and are the projects of individual enthusiastic teaching staff (e.g. Yaneske, 2010).

This paper presents three possible solutions to this problem of finding or creating appropriate games for learning in an environment where increasing monetary pressures exist and budgets are becoming more and more limited. It aims to provide ideas and suggestions for educators and researchers, of alternative approaches to the use of expensive commercial games or high-end game creation. The paper will first consider the background to this issue in more detail, such as the options that are available for finding or developing appropriate games in the current financial climate, and the practical limitations of using high-end commercial games. Second, the paper will consider three alternative approaches to using games to support teaching and learning, by:

- presenting a range of tools and techniques for creating low-cost games;
- considering ways in which teachers can learn from games and apply these techniques to traditional teaching; and
- exploring the notion of empowering students as the game creators themselves.

The paper discusses the relative advantages and potential drawbacks of each of these approaches, and concludes by discussing the future of games and learning in this age of austerity.

2 Background

Worldwide, educators are experiencing the impact of the global financial crisis, with budgets greatly reduced and increased pressure to create cost-efficiencies. There is no question that learning with computer games can be expensive, particularly when it involves the development of high-end graphics or interfaces. This highlights the question of whether computer games are really an appropriate tool to be endorsing in a harsh economic climate. Obtaining or developing appropriate games for formal educational contexts is often problematic; two basic options exist for teachers who want to use digital game-based learning as a teaching tool. First, they can use (or possibly modify) an existing commercial game; second, they could develop an original game from scratch. There are benefits and drawbacks to both of these options, and both are typically expensive.

Commercial entertainment games provide top-end aesthetic quality and game fidelity, giving the look and feel of a professional game, which some argue is important for acceptance by learners. They are usually robust games, thoroughly tested, and explicitly designed to be fun and engage the player, with the benefit of professional design teams and large budgets for development. However, commercial games can be expensive, in terms of purchasing the initial software and any associated hardware. Institutional networks may also not have the capacity for installing or running applications of this nature. A second problem with commercial entertainment games is that they are unlikely to map directly to intended learning outcomes, and players may spend more time learning the game play, mastering a complex interface, or focusing on game goals than learning anything appropriate. In practice, commercial games are typically used in education for imagining possibilities, stimulating creativity or fuelling discussion, rather than teaching content directly (e.g. Squire & Barab, 2004) or for teaching low-level skills (e.g. Miller & Robertson, 2010). Many commercial games now offer the option to extend or modify the basic scenarios, which offers greater potential for mapping to curricula, and this approach has been effectively used to support learning, but again typically as a tool support general creativity and discussion rather than being used directly to teach specific learning outcomes (e.g. Robertson & Howells, 2006). This approach may be limited in terms of the range of games that offer the potential of add modifications (typically role-play and shooters) and the games may still be expensive to purchase.

There is also the potential to use commercial games that have been designed specifically for learning (e.g. Goldsmith & Hall, 2010), which offer many of the benefits of games created for entertainment, in terms of design quality, but are also designed to meet specific learning outcomes so that the game goals align with the learning goals. However, these games can still be expensive to purchase, may be difficult to customise if they do not meet the exact requirements of the learners or curriculum. They also tend to be limited to areas where there are large amounts of potential sales (e.g. generic business skills), so higher levels or more specialist learning areas are less likely to be served. Commercial games may also be difficult to customise to the practicalities of the teaching environment, and issues may arise such as the time taken to play a game segment, and the availability of suitable places to start and stop playing.

The second option, an alternative to using existing commercial games, is to design and develop original bespoke games from scratch. This allows a much closer alignment between learning goals and game design, where the learning outcomes are aligned closely with gaming outcomes for a specific curriculum and student group. The disadvantages of this approach are that a significant amount of skills and expertise is required, in terms of both game design and technical knowledge, as well as aspects like graphics design, narrative design and interaction design. Creation of bespoke games is usually the preserve of educators in scientific or technical disciplines, who have the skills to create appropriate games (e.g. Connolly et al, 2006). Even with the appropriate skills, development is time-consuming and production values are unlikely to be as high quality as top end commercial games; although it has been argued that the graphic fidelity is secondary to game play in engendering engagement (Whitton & Whitton, 2011).

While digital games for learning have sound pedagogic advantages, they also have significant drawbacks in terms of the ability of a typical teacher to obtain and use an appropriate game for a given context. As budgets decrease and less money is available generally in education – and particularly to support innovation in learning and teaching – games may become too expensive to be a viable proposition, in terms of money, time and expertise. However, there are alternative approaches to simply using commercial computer games, or building high-end games to support learning. In the sections that follow, three different approaches to game-based learning without the expense will be presented. First, the option of developing low-cost, lo-fidelity games, such as alternate reality games, or using virtual worlds or one of a growing number of accessible game-builder toolkits to create game-based learning experiences will be considered. Second, learning *from* games rather than *with* them, by examining what games are good at and how they achieve it, and looking for ways to embed those elements in traditional teaching practice, will be discussed. Finally, the idea that learning can be facilitated by giving learners agency as creators of games rather than as consumers, so that they become the developers and it becomes the process, not the product, will be presented.

3 Game development on a budget

Creating high-end games, with high technical specifications and graphics quality, to support learning is beyond the means of the majority of educators, particularly in terms of the technical skills and development time required. However, teachers and lecturers often have excellent ideas for computer-based games to enhance their teaching, and there are various other options for implementing these. One option, which is not discussed in any detail in this paper, is the use of non-digital or traditional games, such as card games and board games (e.g. Baker et al, 2003; Moseley, 2011). This option is appropriate for a whole range of classroom teaching situations and does not require technical skills beyond the production of the physical artefacts associated with the game. There is already a long history of research into the use of traditional games in education, so it will not be discussed further here since the focus of this paper is specifically on computer games.

The use of alternate reality games (ARGs) is a growing area in formal education (e.g. Moseley et al, 2009; Whitton, 2009; Connolly et al, 2011), and one that offers great potential for educators to create engaging game-based learning experiences on a budget. The emergence of ARGs is comparatively recent, and they differ from traditional computer games in that they blend real life and narrative into an 'alternate reality' using a variety of online and real world artefacts such as web tools, social networking sites, as well as physical objects and places. ARGs combine real-life treasure hunting, interactive storytelling, video games and online community (Borland, 2005); they merge the real world and the digital world to create an alternative version of reality, which unfolds in an overarching narrative as the game is played out over several weeks or even months. This interplay between the real world elements and fantasy narrative is one of the defining elements of ARGs, in that they 'take the substance of everyday life and weave it into narratives that layer additional meaning, depth, and interaction upon the real world' (Martin & Chatfield, 2006, p.6). Players work collaboratively in online spaces, and sometimes in the real world, to solve challenges, which can be puzzle-based or involve the creation of real or digital artefacts. This game format potentially provides engaging collaborative learning spaces where students can be supported to work together to achieve desired learning outcomes that map on to the game challenges.

ARGs offer numerous pedagogic benefits, such as the ability to facilitate problem-solving at different difficulty levels, and steady and ongoing progression with tangible rewards. They use of narrative to stimulate curiosity and drive the game action, and players have the agency to influence the game trajectory. Regular delivery of challenges helps to maintain engagement over time and offers space

for reflection, and there is also the potential for a large, active learning community (Moseley, 2008). The fact that alternate reality games are based on simple, existing technologies and do not require high-end production values or technical expertise to build also makes them a particularly affordable option. Previous examples of the use of ARGs in education have met with mixed success because, to some extent, of the cryptic and unfamiliar nature of the genre and its niche appeal. However, there is still a great deal of potential for this genre of games to support learning if student engagement can be supported by linking the game to assessment or a mandatory course activity.

A second option for educators who want to develop low-cost games is the use of multi-user virtual environments (MUVES) as game environments, such as *Second Life* or *OpenSim*. There is debate within the field about whether virtual worlds can be described as games in and of themselves. The author takes the view that while they share some characteristics of games (e.g. use of an avatar, exploration in a virtual space), they are not games in themselves because they are open-ended and do not offer goals or challenges or a structure to interaction. However, virtual worlds do provide the potential for creating simple games, such as competitions or treasure hunts, within the environment; they are a space with many potential uses, games being just one. The advantage of using virtual worlds for game development is that many are free to use (although there may be costs associated with building or owning land), development is relatively quick and easy, and incorporation of communication, such as text or voice chat, is seamless. However, there may be technical issues, particularly when dealing with a range of networks, operating systems and hardware, and some students (particularly those not familiar with three-dimensional game play) may find navigation in environments such as these problematic.

A third option for creating low-cost games is the use of free, or inexpensive, digital game development toolkits, such as Adventure Game Studio (www.adventuregamestudio.co.uk) for developing point-and-click adventure games, Game Maker (www.yoyogames.com/gamemaker) that allows the creation of a whole range of game types, Inform (www.inform-fiction.org) for creating interactive fiction, and Sandbox Gamemaker (sandboxgamemaker.com) for the development of three-dimensional games. These game-builder kits are easy to obtain from the web and cheap to use. While most development environments require the user to have a basic degree of technical ability, they often have large and active online user communities to provide support where required. The use of development kits allows the swift creation of original games that, while they may not match commercial games in terms of graphic quality or fidelity, can still have effective game mechanics and be engaging for learners. While using these game development engines is still associated with a learning curve, they do make the creation of computer games a more feasible option for many educators. However, the potential of games for learning – particularly in an age of austerity – goes beyond simply using computer games as a teaching tool. Games, by their very nature, embed many techniques that facilitate learning and engagement, and the next section focuses on the lessons that can be learned from games and how they can be incorporated into traditional classroom teaching.

4 Learning lessons from games

Game-based learning is not simply about using games to teach. A second way of looking at the potential of games and learning is to see them, not as tools for teaching, but as artefacts to be studied and from which to learn. All games, digital and traditional, naturally embody a range of techniques that help to create effective learning experiences, and ways of stimulating and enhancing player engagement to create environments that are motivational, safe and free from consequences in the real world. Digital games also employ techniques that support interaction, usability and the ability of players to learn the game controls quickly and easily. The study of games in order to determine the range of techniques they use, and how to apply them learning and teaching, offers another potential way of using games for learning without massive expense.

The use of games can be an excellent way to support constructivist pedagogies through active learning and participative teaching approaches. Many games – such as adventure games, role-playing games and simulations – use techniques such as learning through problem-solving or enquiry. They provide a contextualised experience that allows learning through practice, failure, reflection, and repetition; mistake-making and experimenting with different approaches is taken for granted in many genres of computer game. Games can also promote collaboration as players need to work together on shared goals either face-to-face or virtually, in real time or asynchronously. Massively multiplayer role playing games, for example, provide opportunities for real-time team working, mentoring and development of social skills (Duchenet & Moore, 2005). Games also employ mechanisms such as

scaffolding, where lots of help and support is provided for the player at the start, which is gradually removed as the game becomes harder and the player moves from being a novice to an expert. The use of regular, timely intrinsic feedback allows players to see the immediate consequences of their actions and keeps them constantly informed as to their progression through the game.

As well as embodying elements that support active learning, games also employ a variety of techniques for enhancing engagement and keeping players immersed, which could also be employed within learning and teaching situations. These techniques include the use of a structured environment, with clear and meaningful goals, and challenges that are suitably difficult yet achievable. A framework of rules or constraints, with appropriate rewards, such as moving up a level, achieving a place on a high score table or gaining a new artefact or ability also supports ongoing motivation to play. Devices such as competition with other players, stimulation of curiosity through exploration and the discovery of mysteries or secrets, also contribute to engagement. Many games also tap in to the human urge to complete things and collect sets, such as finding all the possible artefacts or finishing a jigsaw, which is another way in which to hook the players and keep them involved in the game.

A crucial aspect of games, particularly in relation to their potential for learning, is that they provide safe and playful environments in which failure is an accepted part of the game dynamic, and learning through mistake-making is the norm. Players do not necessarily expect to complete a game on the first attempt – in fact, that might even be boring – but to re-assess strategies and try again. Games also provide a place for players to have fun, relax and release tension and typically provide environments that are safe from external consequences (although there are some notable exceptions here, such as professional sports), in which players can do things in fantastic or non-realistic environments. This raises the question of the extent to which games for learning can use in-game assessment (where performance in the game directly influences a formal mark) without losing the important safety aspect of the game. In games, players have control over their own actions, the ability to make flexible decisions, freedom to explore the game environment and discover a wide range of potential options, paths and directions within the game. Many games allow players to make a further leap out of the real world with narratives, characters and plots, and often the ability for players to engage further through the creation of their own narratives or digital artefacts.

While there are some aspects of all games that could potentially be studied and applied to traditional teaching, there are also some that are specific to digital games. Computer games can teach a lot about successful interaction design, which could be applied to the design and development of online learning and teaching experiences. This includes the effective use of visual and auditory media, such as pictures, graphics, animation, video, and sounds, and appropriate ways in which to use multiple media in a single environment. Games can also exemplify excellent interaction design such as the ways in which players access game functions, game usability and user-centred design. There is also much to be gained from the study of learnability of game interfaces, as game players will typically not engage with manuals or tutorials but want to start playing the game straight away; discovering the options available in a game environment is often half of the fun of playing the game. Further study of what makes gaming interfaces usable and entertaining and how this could be applied to online learning interfaces, as well as how to apply more general game principles into traditional teaching and learning would allow educators to learn from what is good about digital games without the expense of high-end development.

5 Learning by building games

In the field of game-based learning, there has been growing interest in recent years in the use of games to support students to learn by developing or creating games for themselves, rather than simply being players of games (e.g. Korte et al, 2007; Al-Bow et al, 2009; Lim, 2008; Robertson & Howells, 2008). This is an approach that many learners, particularly school-age males, are likely to be enthusiastic in developing and has the advantage that it gives learners greater agency and control over the process of game creation, supporting them to learn a whole host of associated design, planning, communication and teamwork skills.

Game creation can be long and complex, requiring a variety of technical and design skills. Prensky (2008) argues that there is a fundamental difference between ‘mini-games’, which are simple, focused and take less than an hour to play, and ‘complex games’, which are the typical large-scale commercial game, rich and multi-faceted, with many hours of game play. He says that mini-games are more appropriate for education games, particularly those developed by learners because the “design of

mini-games is relatively simple, and is often easily borrowed from other mini-games. Game construction takes a couple of months at most, and testing is relatively easy.” (p1006). While this approach provides a realistic option for development by learners, and may be valuable for supporting learning-by-development, these games tend to be based around knowledge-acquisition and other low-level learning outcomes, and do not make full use of the potential of games as constructivist learning environments. Game design for learning has been used effectively, however, Lim (2008) argues that using game-based learning or students as game designers within traditional institutional frameworks will be ineffective because “computer games challenge the prevailing culture of schools where externally determined knowledge is packed clearly for teachers to dispense to their students. If bringing games into schools merely reproduce these power relations or knowledge transmission, it is unlikely going to be any significant increase in learning engagement among students.” (p1002). He suggests that fundamental changes such as redesign of the curriculum to focus on key questions, re-structure of timetables, and a focus on assessment for learning (rather than assessment for evaluation) are necessary before game development can truly support learning.

The easy availability of game development tools and modification engines (such as the selection described in section 3) make the development of games by learners a feasible option, but still some level of technical and design expertise is required by students, as well as confidence by teachers to support teaching in this manner. A further drawback of this approach is that it will be time consuming, require a great deal of commitment on the part of both teacher and learners, and will only be suitable in a limited number of contexts where it is possible to meet the desired learning outcomes through the process of game development. While using the model of learners as game creators can be a very effective pedagogic tool, it is applicable to a limited number of curricula, and the institutional infrastructure needs to be in place to make this approach effective.

6 Conclusions

This paper has presented three alternative ways of approaching game-based learning, beyond the more usual models of using commercial or enthusiast-developed games in formal teaching situations. Finding, or creating, appropriate games for specific learning situations is one of the main difficulties of game-based learning, particularly when learner numbers are relatively low and value-for-money is an objective. Games can be shown to be a very effective way for students to learn, but not necessarily an efficient one in terms of the expense of creation and deployment. The three solutions offered in this paper are not presented as the only alternative options, but are intended to encourage game developers, educators and researchers to think beyond the more typical ways of using games for learning.

Of course, each of the possible solutions discussed here is not without its disadvantages. While the possibility of developing low cost games is tempting in terms of the lesser expense in buying development software, they may still be expensive in terms of the time taken to develop. The process of creating a good game, even if the actual development cost is ignored, is long and involves creativity, specialist skills, and comprehensive testing. The process of designing any game that is fun to play and appropriate for learning is never easy – whether it is a high-end digital game or one played with pencil and paper. Getting that balance right takes practice, play-testing and a willingness to ‘go back to the drawing board’. Other specialist skills may also be needed in the design and development process, such as graphic design, narrative design, or interaction design skills, even when low cost or accessible development software is used. There is always the possibility that low cost games, or amateur designs could put learners off, although this is debatable and arguable that learners do not compare the aesthetic quality of learning games with high end entertainment games, they compare them with traditional learning activities (Whitton & Whitton, 2011). A final drawback is particularly associated with the ARG format (but holds true for any emerging game genre), which may be unfamiliar to many learners, and therefore may have a steep learning curve just to get students to appreciate and accept the philosophy and mechanics of the game – before they even engage with the intended learning outcomes.

The idea of learning from games, identifying what they do well and how this could be used in education is also problematic in some ways. There is a danger that the use of game techniques, particularly simple techniques such as scoring, prizes or the use of high score tables (sometimes called gamification) may be seen by learners as trivialising learning, or put an emphasis on meeting game objectives without learning. This approach focuses on game techniques that support extrinsic motivation, while those that support intrinsic motivation to play can have a more profound effect. The

lessons learned from games need to be deeper and richer, looking at the underlying motivational and pedagogic lessons, and further research is essential to ensure the appropriateness of these techniques in an educational setting. This is the case in terms of the perceptions of the learners, as well as teachers, and in relation to the pedagogic value created. It is also crucial to remember that while some elements of games may be motivational for some, this might not be the case for others; in particular, things such as the use of competition and fantasy may have limited appeal. There are also issues with the approach of learners as game creators. This method may only be appropriate in certain circumstances, for certain curricula elements and with certain groups of learners. While some learners may find game creation intrinsically motivational, it is crucial not to forget that others will simply not be interested. This pedagogic approach will also require additional skills from the learner – such as teamwork, negotiation, planning and time management – and from the teachers – such as trust and willingness to move from being the holder of knowledge to the role of co-learner.

While there is evidence that computer game based learning can be an effective tool for creating active learning and teaching experiences, and engaging students in safe and playful spaces, the costs associated with obtaining, or developing high-end games may make their mainstream use prohibitively expensive, particularly in an increasingly-difficult economic climate. This paper has aimed to suggest other ways in which games can be used to support and enhance learning, beyond simply using them as vehicles for learning. There are certainly other approaches to the issue of how to lower the expense of game based learning in a difficult economic climate, but this paper hopes to open up the discussion in this area and encourages people to bring new ideas and thoughts into the forum. In this way, through conversation and the sharing of ideas, it is hoped to make learning with digital games a more accessible option for a wider range of educators.

Practitioners, researchers and policy-makers in the field of digital game-based learning need to re-think the true value of games, and focus on instances where they add significant value to a learning experience. The cost-effectiveness of games needs to be taken into account, and evaluations of game-based methods need to take this into account as well as simply considering the pedagogic effectiveness of the approach. Digital game-based learning should be used when appropriate, and seen as another tool in the educators' toolkit, rather than a solution that can necessarily be implemented into the educational mainstream. The three solutions outlined in this paper offer alternative ways of thinking about the potential of digital games for learning, beyond the model of big budget commercial games. The low-cost ways in which teachers and lecturers can build their own games, to support their own practice and students, could be used to build up an evidence base of examples of innovative practice. It could also be used to provide examples of when games are less successful, so that the community can learn from mistakes without the political imperative of justifying large amounts of money invested by always telling a success story. However, the use of digital games in education also has to move beyond simply using games to teach content, but using the elements that make computer games, and their design, effective for learning and engaging educators to reconceptualise and re-think the practice of learning and teaching as a whole. A move from didactic content-focussed pedagogies to collaborative co-construction of knowledge is essential to support learners to gain the critical thinking and information literacy skills they will need for the future, and games (as well as other innovative pedagogies) can be a key tool to underpin this transition. In conclusion, this paper aims to offer alternative ways of thinking about the potential of digital games for learning, and present possible solutions to the increasing financial constraints that face the field of education.

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