mGBL in Architecture: Using Mobile Games to Support the Training of Architects in HE

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ABSTRACT

This paper will investigate the potential of mGBL (mobile game-based learning) in the context of architecture education. Initially it will provide a rational on the use of mobile games as effective learning tools for architecture students. The focus is on adult learners, students of HE (Higher Education), who have different needs in comparison to children learners. Initially the paper will examine the potential benefits of learning via games, the profile of contemporary adult learners and the affordances provided by the mobile context. It will move on to propose two possible models of application relevant to architecture students. It will look into how an adventure mobile game, based on constructivist educational theory, can assist collaborative learning and how a puzzle mobile game, based on behaviourist educational theory, can be utilized to assist skills development. In conclusion the paper will argue towards the suitability of mobile games to support the education of architects, bringing together two major affordances: game engagement and mobile accessibility.

Keywords: *mGBL, mobile games, adult learners, architectural education, Higher Education.*

INTRODUCTION

Over the past few years, interest on the possibilities of learning mediated via mobile devices has been increasing, especially in the academic sector. Mobile technologies such as smartphones and tablets are predicted to play a key role in the future of education. The technological evolution of mobile devices, extending their capabilities and constantly adding new features, facilitate the development of new educational models capable to support the learning of adults today. On the same time the mobile market is growing, with devices becoming more accessible and therefore integrated in everyday social life. Students in Higher Education today are already mobile devices' owner and users, which from an educational perspective begs for innovative learning frameworks that utilise this affordance and bring on-the-go learning content to the individual device. In this context learning models can truly be 'anytime and anywhere' (Geddes, 2004). Additionally such mobile-informed approached to learning can

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facilitate a number of frameworks including learning just in time and on demand (for highly specialised tasks), spaced learning (for repetition until mastery), microlearning (for manageable chunks of training content), lifelong learning (for learning databases through changing life roles) etc.

Further to the development of various types of mobile learning frameworks however, rapid is also the increasing importance of educational games especially when game-based learning can be facilitated via mobile devices, thus combining the benefits of mobility and increased engagement. Mobile games, reflecting casual values in regards to gameplay, have opened up gaming to a wide range of audiences. Additionally they are nowadays among the most popular applications used on mobile devices, popular in a wide demographic far more inclusive than that of traditional computer games. Mobile games therefore pose a great potential for the distribution of learning to contemporary adults.

It is here argued that such games can be an effective educational medium, highly applicable to architectural education and more specifically to the training of architects. This paper will investigate the opportunities of learning mediated via mobile games and is organised in the following sections. The first section looks into the potential benefits of learning games. Then the profile of contemporary Higher Education learners is briefly presented, followed by a discussion of mobile affordances for learning. On the final section, two mobile game-based learning frameworks are proposed, as possible application of mobile gaming into the training of young architects each corresponding to a different game genre, learning theory and model of integration.

LEARNING THROUGH GAMES

Game-based learning is learning facilitated via a game. Educational games often referred to as ‘serious games’ or ‘games with a purpose’ bring major benefits especially for younger generations of learners. The success of games as educational tools is accounted to their strong relation with play, a natural human activity fundamental to the development of both children and adults (Rieber, 1996). The act of play in a computer game can facilitate the evolution of human experience in a safe environment, providing opportunities to practice skills and explore behaviours that can then be transferred into everyday life (Koster, 2005). Game-based learning pioneer James Paul Gee simply argues that: ‘games are good for learning’ (Gee, 2003). Today there are various successful examples of games used to assist learning, addressing both children and adults in various settings, while game-based learning is considered among the educational technologies ‘to watch for’ according to The Horizon Report (Johnson et al., 2011).

One of the reasons why games are considered good for learning is that they are often quite successful in retaining engagement and keeping the player motivated. The fact that games are intrinsically motivating has been supported by various literature (Prensky, 2001; Oblinger,

2004; Crawford, 1982). Engagement in games can be facilitated via 'flow' (Csikszentmihalyi, 1992); a state of 'flow' describes an optimal balance between the challenge of the game and the skills of the player, where gameplay is considered to be neither too easy nor too difficult, thus retaining the player engaged. In a state of optimal flow the player allocates all his cognitive resources to the game, is fully emerged and enjoys the experience (Prensky, 2001). Prensky (2001) also supports the engaging values of games and argues that they can effectively teach essential 21st century skills. He writes: 'computer and video games are potentially the most engaging pastime in the history of mankind' (Prensky, 2001, p. 106) and provides a list of the elements that make games engaging including fun, rules, goals, feedback and problem-solving among others.

Furthermore, games have embedded a lot of good learning principles and are very successful in teaching people new transferable skills (Gee, 2003). In his 2005 book: 'Why Are Video Games Good for Your Soul: Pleasure and Learning', James Paul Gee claims that games externalize the way the human mind works better than all other technologies available, in that they are the perfect metaphor of the mind as simulator. They provide a visual, auditory world to manipulate and reset thus preparing people for actions needed to accomplish goals (Gee, 2005). Gee is supported in his claims on the cognitive benefits of games by a variety of research, while according to Aguilera and Mendiz: 'a number of studies indicate that games are conducive to the development of special skills like attention, spatial concentration, problem solving, decision-making, collaborative work, creativity and ICT skills' (2003, p. 8). Finally it is important to point out that learning is not only a cognitive but also an emotional process and games can offer pleasurable experiences and facilitate positive emotions that positively impact the learning process (Baker et al., 2010).

THE LEARNER PROFILE

When evaluating the suitability of mobile games for learning in Higher Education, the profile of contemporary learners should also be considered. Students in Higher Education are adults and therefore should be distinguished to children learners. According to andragogy, which describes adult learning theory (Knowles, 1998), motivations of adults in regards to their learning include self-direction, real-life relevancy, task orientation and learning in context among others. Extending on andragogy, Simpson (1980) pointed out that the two main traits in adult learners are the need to be autonomous and self-directing and the use of past experience as resource.

Furthermore game-based learning frameworks comply with the changing profile of contemporary adult learners. The 'Games Generation' (Prensky, 2001), consists of adults who grew up playing games and who use them to learn instinctively, in comparison to older generations of learners who may be more prone to traditional educational strategies (Prensky, 2001). Prensky also argues that the games generation presents cognitive changes, while its immersiveness

into technology has fundamentally altered the way people accumulate and assimilate information (Prensky, 2001). Contemporary adults therefore have a need for learning able to facilitate fast-pace, non-linear, self-directed, collaborative, problem-solving and visually rich technology-enhanced learning (Prensky, 2001). Game-based learning is thus considered suitable to contribute to the development of a particular disposition well suited to an information-based culture (Johnson et al., 2011), responding to the changing needs of the games generation.

MOBILE AFFORDANCES

We are currently living in a 'mobile society' (Traxler, 2007), where the market growth of mobile technologies is phenomenal. Statistics show that more than 6 billon mobile phone connections existed worldwide in 2011, while numbers are expected to grow to 12 billion by 2020 (ITU, 2012). Technologies adopted into everyday social life can often account for powerful educational interventions and therefore have an impact on how people learn. Students today carry mobile devices, using them to support aspects of their daily social life including communication and learning. Innovative educational frameworks need to therefore be developed to utilize this affordance in the context of learning in Higher Education.

Further to social practices however, circumstances of use of mobile technology should be considered. The need for constant movement becomes imperative in a mobile society. Mobile content can be accessed on demand, anytime and in any location since mobile devices have become ubiquitous and are always switched on and attached to the user. On the same time such devices are usually individually owned therefore customizable, thus becoming a suitable technology for personalized content delivery. Furthermore the intuitive design of contemporary devices coupled with accessible UI and touch-based interactions, cultivates a feeling of familiarity, making them accessible to a wide-ranging audience. This feeling of safety and confidence in using the device and accessing content on the go, eliminates any negative perceptions often experienced with technology-enhanced educational solutions (Jones, Issroff and Scanlon, 2007). Finally it is important to note that mobility allows learning to be seamlessly integrated into the daily life of the learner, while accessibility and ownership can account for a truly learner-centred solution.

mGBL FOR THE TRAINING OF ARCHITECTS

Thus far a rational for the suitability of mobile games for learning has been provided. The next section will look into two possible case studies of the implementation of mobile game-based learning for the training of architects in Higher Education. In the first case an adventure game based on a constructivist approach to learning will be discussed, while on the second a puzzle game based on behaviourism and microlearning principles will be proposed.

m-ADVENTURE GAMES FOR CONSTRUCTIVIST LEARNING

Mobile devices are well suited to facilitate constructivist learning where learners are embedded in realistic contexts and on the same time have access to supporting tools (Naismith et. al, 2004). Constructivism is based around the idea that learning is active and that learners construct their own knowledge via active engagement in learning, building on past knowledge and experiences (Bruner,1966). Honebein (1996), proposed a number of educational characteristics of constructivist learning environments, including the support of students to take responsibility for their own learning, strategies for problem-solving, encouragement of the ownership of learning, realistic and relevant learning based on authentic, real-life activities and use of rich media, among others. In this light, game-based learning becomes a suitable framework for learning because of the way constructivism can be reflected in a game environment, facilitating the above characteristics; even more so coupled with mobility where learning can be situated and take place in context.

Mobile applications can thus support the constructivist paradigm by providing opportunities for learners to actively construct own knowledge via being embedded in realistic contexts (Naismith et. al, 2004). Furthermore, games allow knowledge construction via rich interactive environments suitable for exploration, inside which, learners can practice skills and exercise problem solving. In this context adventure games become particularly relevant since they involve undertaking a series of actions, interacting with other characters, objects and/or the game environment to reach a goal. The mobile platform offers interesting possibilities for adventure games, which are quite popular on mobile, since the traditional point-and-click interface is a natural fit for devices featuring touch control systems (Unger and Novak, 2012). Prensky (2001) argues that adventure as a game type, is particularly suitable to support learning outcomes that involved development of skills, judgment, reasoning and continuous practice, thus able to support active construction of knowledge.

In a Higher Education context, one of the most interesting perspectives of constructivism is social constructivism through collaboration, proposed by Vygotsky (1978). Social constructivism views learning as taking place initially at a social level and then at an individual one (Vygotsky, 1978). This model requires conversation and sharing between learners in a context of problem solving, via reasoning and collaboration. This interaction between learners can be highly applicable in the architecture design studio. Via social interactions participants can construct knowledge together and influence each other, immersing in a collaborative, creative application of theory to practical tasks.

Mobile games are mediated via mobile devices, which allow communication in various ways. Synchronous and asynchronous communication is nowadays supported via web access and text messaging. This allows for the easy development of learners'

communities. Multi-player games allow for more than one players interacting with the system at one time, and thus can potentially support collaborative learning. Quite popular are also turn-based games on mobile devices, where players take turns in working towards a specific goal. Both multiplayer and turn-based games can be incorporated into the curriculum to engage students in constructivist learning with peers, utilizing own devices.

The integration model for this framework could be an embedded game, either in a single or in multiple sessions. Students would in such a context be able to download the game into their devices (or to one device per group) and then work together to achieve a task. Embedding a game into the curriculum means that the teacher can supervise and assist students while they work on the game, the objectives of which should align with the learning objectives of a given course. Embedding a game completely within the curriculum and making it the focus for teaching is an approach that has much in common with problem-based learning (Whitton, 2010). Game mechanics could be enhanced further to support situated learning, where students can work in context (on location), designing or redesigning a building under specific requirements via collaborative brainstorming, sharing and participatory design of a 3D model in virtual space.

m-PUZZLE GAMES FOR BEHAVIOURIST LEARNING

Mobile devices are excellent for drill and practice exercises thus provide great potential for behaviourist learning (Naismith et. al, 2004). Mobile games could therefore be used to present learning materials, get responses from students and provide relevant feedback. Drawing on Skinner's (1968) paradigm on behaviourism, learning could be best facilitated via associations between a particular stimulus and a response. Applying this to mobile game-based learning, the learner should contribute to finding a solution to a problem posed by the system. Drill and feedback learning activities offer a number of advantages in a mobile context including customization of content and feedback to suit the curriculum and data gathering about the individual progress of students (Naismith et. al, 2004).

Puzzle games are considered quite successful in facilitating behaviourist learning in a mobile context, since they conform to a - provide stimulus, await response and give feedback - model. According to Prensky (2001), puzzle games are appropriate to facilitate learning outcomes that involve development of skills, association, continuous practice and recall of facts. Puzzle games as a genre involve primarily problem solving which is embedded in gameplay in various formats. Mobile puzzle games are easy to pick up and play, provide mental challenge and support mini-level architecture, which is ideal for microlearning.

Microlearning is based around the idea of developing smaller and manageable chunks of learning content. Applications providing learning micro-content are ideal for mobile devices since they allow learning to

be embedded into on-going activities of daily life. Additionally microlearning works quite well with mobile devices' limitations such as variations in platforms, small screen-size and consistent presentation of information. Examples of microlearning activities may include answering a quiz question, viewing a flashcard, reading a paragraph of text, listening to an audio clip or viewing a video clip etc. Microlearning has been supported in literature on learning psychology (Simon, 1974) and human cognition, which places the limits of information processing in short-term memory (Cowan, 2001). According to Simon (1974) people can learn better and more effectively when the content is broken down to digestible parts and learning takes place in small steps. However it is important to note that although micro-content is suitable for learning environments where learning can be designed in smaller objects, it may not be appropriate for all forms of learning (Bruck et. al, 2012). Depending on the type of learning, micro, meso and macro aspects vary and are relational. For example in the context of architectural education mobile puzzle games may be suitable for review and training purposes as well as support of facts memorisation or recall.

In this case a model of integration into an architecture course could be in the form of an optional game activity. This add-on activity could be proposed by the tutor to be taken independently by the student, outside of the classroom. The mobile puzzle game, the content of which should be designed to align with semester taught content, could be directly downloaded to the students device and be available to play anytime and anywhere. The game could act as a review mechanism to support repetition of learning content previously taught in class and allow retention via spaced revisions. Since this model is used as an addition to a course, it is not replacing face-to-face teaching but rather extends it, providing a motivating way to keep engaging with learning content when outside of the classroom.

CONCLUSION

This paper has examined mobile game-based learning in the context of architecture education. Initially it provided a rational for the use of mobile games for the training of architecture students, looking at the learning (game-based), the learner (adult) and the context (mobile). It then moved on to proposed two possible applications of mobile game-based leaning in Higher Education based on two established learning theories, constructivism and behaviourism and mediated via two popular mobile game genres, adventure and puzzle. In the first instance, more advanced cognitive skills can be supported via collaborative knowledge development. It is therefore proposed that this first model is best suited for application in the classroom or on location, supporting the design studio practice. The second model focused on drill and practice exercises in he form of a game played individually during the learner's own time. This model is best suited to skills training, via repetition, revision and spaced microlearning, extending the work done in class. Both models arguably have interesting potential for learning and are therefore considered appropriate for the context of architectural education.

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