Supporting knowledge construction with mobile learning games

Birgit Schmitz

Humance AG
Goebenstraße 10-12, 50672 Köln, Germany
bschmitz@humance.de

Abstract. This project researches the potential of mobile learning games to support information access and motivation for educationally disadvantaged learners. Based on the Game Design Patterns for Mobile Games by Davidsson et. al [6] it will analyse existing didactic methods/patterns used within mobile learning games to impart subject related knowledge. The identified patterns will provide the base for developing an exemplary concept prototype application for mobile learning games. The prototype will be used to empirically test how the relevant game design patterns influence learning and teaching and scrutinize the interplay of game design patterns and possible corresponding educational objectives. The test results will lead to recommendations of how mobile learning games should be designed to effectively support motivation and information access for learners difficult to reach.

Keywords: mobile learning games, game design patterns, learners difficlt to reach

1 Introduction

Making education accessible to everyone is a problem: Unterfrauner [21] states that the smaller the income the smaller the penetration rate of PCs and the smaller the possibility for youths to have access the internet (no access point). Also, according to the JIM Study [13] the level of education influences the kind of device that is prevailing. It states that the higher the educational background the more likely youths are equipped with computer, internet or digital camera whereas with game consoles and television it is contrariwise. Hence, social circumstances reinforce prevailing educational disadvantages. With regard to mobile devices, the situation changes though. Nearly all youths (99%) at the age of 13-19 years possess a mobile phone regardless of their social or educational background [13]. By now, the cell phone is the most widely adopted mobile console in the world and cell phone games are most likely to become the biggest platform in the coming years [11] with the rapidly developing mobile technology paving the way. The process power and screen resolution of mobile devices is steadily increasing, they have enhanced memory and the possibilities to access the internet or to communicate with one another are

constantly improving [19, 8, 15] making content portable and conveniently accessible anytime, everywhere and whenever needed [20, 18]. This way mobile technology offers enormous potential for teaching and learning (cf. [5], [19], [12]).

This Phd-work researches the educational potential of mobile learning games for educationally disadvantaged learners i.e. learners that are hard to reach, hard to access or hard to engage (e.g. third chance education). It is related to the German BMBF-funded research project SpITKom that focuses on the acquisition of subject-related (IT-) knowledge for educationally disadvantaged learners.

2 Research question

This PhD-work studies the design, use conditions and effects of mobile learning games that aim at supporting learners difficult to reach. With special regard to the target group's needs it scrutinizes how mobile learning games can effectively contribute to the creation of situative learning scenarios that amongst other things enhance encoding and recall (cf. [18], [11]). In this effort, it resorts to the Game Design Patterns for Mobile Games [6]. It analyses existing learning games according to this categorization and aims at identifying those patterns that effectively support the acquisition of knowledge for learners difficult to reach. It thereby concentrates on the acquisition of knowledge on the levels of knowledge and skills. According to Bloom's taxonomy [3] this relates to the lowest level of educational objectives in the cognitive domain (knowledge, comprehension, application, analysis, synthesis, evaluation). The main objectives of this PhD-work therefore can be summarized as follows:

- What are effective mobile game design patterns to support learners?
- How can Game Design Patterns for Mobile Games be used to deliver new forms of effective and joyful situated learning?
- What are best practices for mobile learning games to support knowledge, comprehension and application?

As a secondary objective this project is (1) to create an exemplary concept prototype for mobile learning games that can be described as an effective and motivating learning scenario and (2) to present instructional design guidelines for the development and application of effective and motivating mobile learning games that address learners difficult to reach.

3 Relevance

This research project deals with the merge of the two different concepts of *learning* and *gaming* and relates them to the increasingly important aspect of mobile technology in the process of learning. It brings together relevant research results and recent developments from the field of mobile technology and game technology that are both paving the way for the growing use of mobile (learning) games and takes into consideration parallel developments in the field of the pattern approach.

3.1 Mobile technology

Findings from research on mobile learning projects frequently indicate the unique opportunities mobile technologies (i.e. PDAs, Smartphone, mobile phones, etc.) provide for educational purposes (e.g., [5], [19], [2]): Learning with mobile devices means using real-world resources that can make education more meaningful [12]. Compared to other technologies, mobile devices tend to be relatively simple to use and learners may be able to provide support to each other [5]. The size of learning material delivered by mobile devices is comparatively small. Learners can proceed at their own pace and access content to improve their basic skills [20]. This way, mobile devices help learners to recognize their existing abilities and to develop and improve confidence, autonomy and engagement [5, 19]).

Up to now, mobile devices are not instantly associated with the learning. They are in use primarily for communication and entertainment purposes [21]. It can therefore be expected that learners are more readily prepared to use mobile devices for the learning because they are a cool thing to use, the learning is not instantly obvious to others and mobile devices are nearly always at hand anyway [16]. Thus, mobile devices offer low-threshold learning opportunities that can help solving the motivational problems third chance education has. Findings of the Mobile Learning NETwork (MoLeNET programme) for example support this assumption [5].

3.2 Game Based Learning

According to the JIM study [13], game based learning approaches seem to be another way of providing the target group with motivating, low-threshold learning offers. Learning by playing has a very long tradition in the theory and practice of pedagogy and psychology (cf. [9]). Also, computer games have been into existence for quite a long time. The combination of both, namely learning by playing a computer game (digital game based learning) has rapidly become subject to research activities [10].

Supporters of using digital game environments for the learning frequently refer to their potential to offer more self-determined and motivating ways to learn which is often missing in traditional computer-based training systems (cf. [14, [1, [17]). Recent research results (cf. [7]) claim that computer games for educational use provide for e.g. increased motivation, more interest in a subject or simulations that present material differently.

Playing games whether they are explicitly designed to foster the acquisition of knowledge or not, may support the development of certain strategies and skills such as problem-solving, decision-making, understanding complex systems, planning or data handling for example [17]. Also, they support the acquisition of factual knowledge [17] according to a predefined set of subject related facts that can be matched against a fixed syllabus or standardised testings.

What is missing though, when considering the use of Game Based Learning approaches for educational purposes is guidance in the sense of *why and how are mobile learning games effective*? Patterns are able to provide this guidance.

3.3 Patterns

When talking about games it is mostly referred to game genres i.e. firstperson shooters, strategy games, etc. (cf. [17]). In the context of educational games, this categorisation is not stable and rather difficult to apply though [6]. This is due to the vital need of tailoring learning offers (i.e. educational games) according to the learners needs and according to the learning target instead of fixed genre features. Björk et. al [4] have therefore proposed a more unified apporach. They have presented a model "… to support the design, analysis, and comparison of games through the use of game design patterns …" Their approach reflects the need for a common structure and language for games to better understand the complex issue.

Davidsson et al. [6] have expanded this already existing set of Game Design Patterns by 75 new patterns that describe the unique characteristics of mobile games [6]. The new collection (Game Design Patterns for Mobile Games) was identified and verified out of existing commercial mobile games and games categorized as "experimental" or "research" mobile games. For this PhD-work, this set of Game Design Patterns for Mobile Games introduced by Davidson et al. [6] serves as starting basis to establish a set of guidelines for the instructional design of mobile learning games (Game Patterns for Mobile Learning Support) that support knowledge construction for learners difficult to reach.

4 Method

The research project has been organised into four studies:

1) *Study 1 (Literature review)* reflects the subject of Mobile Game Based Learning from different perspectives. It comprises a general overview of the literature in the field of mobile learning projects and depicts state of the art design and use of mobile games scrutinizing the prospects of applying them to educational scenarios. The study will be based on the Game Design Patterns for Mobile Games [6]. Their approach will help to identify game elements (mobile game design patterns) that are relevant for the acquisition of subject-related knowledge. The literature review will be the base for further research into the mechanisms of mobile learning game design.
2) *Study 2 (Information access and motivation)* scrutinizes how Game Design Patterns for Mobile Games influence information access and motivation for learners difficult to reach. For this study, an exemplary concept prototype for mobile learning games will be developed that is based on the patterns identified in the analysis of mobile learning games as described above.
3) *Study 3 (Subject-related knowledge)* applies the results from study 2 (patterns that influence motivation and information access). By varying the level of knowledge this study will provide insight into the extent to which mobile learning games might be employed as a tool to support the acquisition of subject-related knowledge.
4) *Study 4 (Conditions of use),* consolidates the experiments and evaluates their outcome. As a result it will extend the Game Design Patterns for Mobile Games to

a set of Game Patterns for Mobile Learning Support. Thus, this study will offer recommendations for educators, instructional designers and teachers as to the design of mobile learning games that support subject-related knowledge construction for learners difficult to reach.

5 Evaluation Design

In a broader sense, the different game design patterns can be taken as different teaching methods or at least as elements of the rather generalizing teaching method *game based learning*. However, this project will not research the "best" method/pattern to acquire subject-related knowledge. It will rather proof that for a given target group (learners difficult to reach) and delivered via mobile devices certain patterns have positive effects on (1) the learning gains (Knowledge, Comprehension), (2) the capacity to retain knowledge, (3) the learners contentment and (4) the learners self-assessment (regarding the achievements). Indicators such as effects on the learning gains and the capacity to retain knowledge (learning performance) will be assessed by guided tests with both the control group and the experimental group. Additionally for the learner's contentment and self-assessment, the participants will be interviewed.

The experiments will be carried out as field or quasi-experiments with a post-test control group and an experimental group. A pre-test will guarantee an effective experimental setting. It will be carried out to have both the experimental and the posttest control group as homogenous as possible thus lessening bias. The experiments for both studies will be carried out with a fixed group of learners recruited from the ongoing research project SpITKom. The mobile devices necessary for the experiments will be provided by the project.

6 Conclusion

Up to now, no experiments have been conducted in the course of this Phd-work to seize the influence of mobile learning games on motivation and information access for learners difficult to reach. However, this approach assumes that mobile learning games provide a promising way to lead these learners back into education because (a) the target group is almost consistently in possession of mobile devices which they (b) use on a daily basis and (c) they are attracted to computer games. Therefore, this project focuses on how mobile learning games should be designed, to meet the target group's needs. So far, no comprehensive research has been conducted on the use and the design of mobile learning games to support learners difficult to reach.

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