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Towards a Persuasive Design Pattern for a Gamified M-Learning Environment

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Abstract. New innovative technologies create opportunities for persuasive engagement. Persuasive technology is all about software, systems and applications designed to hook, reinforce, change and shape the attitudes of the learners without using coercion or deception. Persuasive design pattern if applied effectively and efficiently may influence learners' attitudes towards the learning task, and may hook them to the specific learning activity offered via a gamified mobile application. In this paper the concept of persuasive design pattern in gamified m-learning platforms should be introduced to the scientific community. Persuasive design in a gamified mobile learning environment is described and persuasive set of design patterns appropriate to a gamified mobile environment is introduced. These persuasive design pattern are divided into three categories to suit to the appropriate learning environment.

Keywords: *persuasive design pattern, m-learning, mobile apps, gamification*

1 Introduction

Mobile devices have the potential to revolutionize educational pedagogies (Metz 2014) with learning concepts which are personalized, contextualized and devoid of temporal and environmental constraints (Crompton 2013a). Educators search for new ways of engaging their learners and hence, there is a growing interest in exploiting the affordances of mobile devices for educational purposes (Ally and Prieto-Blazquez, 2014; Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sánchez and Vavoula 2009). Traditional methods of designing educational systems have focused on the tasks users are likely to complete as opposed to designing them to persuade the user to develop knowledge or to learn about topics. Successful mobile learning systems allow the user to interact with the environment using mediating artifacts, which are conductors for action within these environments. Mediating artifacts in mobile learning systems take many forms, e.g. text that offers the perceived affordance of clicking, icons that offer the perceived affordance of dragging etc. Persuasive technology is all about software, systems and applications designed to hook, reinforce, change and shape the attitudes of the learners without using coercion or deception (Oliver and Pelletier 2006). Many e-learning systems are based around mediating artifacts, but few of these have been designed to encourage learners to carry actions in order to meet their goals.

This paper will introduce and explain the idea of persuasive design patterns in a gamified m-learning environment. To do so, in the following section persuasive design in a gamified mobile learning environment is described and a persuasive set of design patterns appropriate to a gamified mobile environment is introduced. In the remainder of the paper, these persuasion design pattern are divided into three categories to suit to the appropriate

learning environment. This paper will end with a conclusion and a outlook for future research in this new research application field.

2 Context and Related Work

In this paper we are aiming at answering the following research questions: What kind of persuasive design patterns could be applied to enhance learning and teaching applications via gamified mobile learning environments? Which persuasive design patterns support learning and assist students to attain an appropriate learning atmosphere and get students hooked to the learning task/activity?

Our hypothesis is that through the application of persuasive design pattern in a gamified mobile learning application, students' learning will be improved. The objective of this paper is to introduce persuasive design patterns in order to persuade students to use a gamified mobile learning app. To introduce persuasive design patterns in a gamified mobile learning app, mobile learning, mobile apps, gamification and persuasion design patterns are described in more detail in the following.

Mobile learning: Mobile learning, or short m-learning, refers to learning that happens involving the use of a mobile device. M-learning is formally defined as "learning across multiple contexts, through social and content interactions, using personal electronic devices" (Crompton 2013a, p. 4). This definition highlights the substructure on which mobile learning is based, which are pedagogies, context, social interactions and technological devices (Crompton 2013b). It highlights pedagogies that can be used to extended as learning. The context is the environment students can learn in and also the multiple subject areas they can learn about. Social and content interactions are significantly enhanced by the use of mobile devices as learners can interact with others at a local and global level as they collaborate, discussion, create and inform others. For example, at a local level students may email or connect on social networks with people they know. At a global level, students can have in-depth discussions in open forums. Finally, the mobile devices are the tools that can be utilized to take advantage of these opportunities.

Mobile application: Seilhamer et al. (2013) define a mobile app as on demand mobile software that runs on a mobile architecture and has unique features such as touch-based, robustness, seamless and very efficient application. There are three types of mobile applications each of which comes with unique features.

- **Hybrid apps** are cross-platform and combine both characteristics of native and web/cloud apps, they run on the device itself, but they run inside a native container within the operating system of the device itself (Khaddage and Lattemann 2015)
- **Native apps** are device and operating system specific, they are most suitable for gaming, as they provide high quality graphics and speed since they run within the device engine, thus making them the most engaging robust apps (Korf and Oksman, 2012)
- **Web/Cloud apps** are server side apps (cloud-based or web-based), are device independent and run on all platforms. They only use the browser of the mobile device and they support BYOD (Bring Your Own Device) (Khaddage and Lattemann 2013).

3 Pervasive E-Learning

It is widely accepted that learners should actively question ideas and concepts presented to them by educators (Golden et al. 2002). When students pose questions in class, they are more engaged and experience more autonomy (Etkina, 2000; Marback-Ad and Sokolove,

2000). But learners should also question their own attitudes, beliefs, and experiences. To change attitudes, beliefs, and experiences educators need to adopt context-specific and culture specific **persuasive** approaches, such as posing guiding questions, encouraging open discussion and seeking confirmation from learners to ensure that the presented concepts have been accepted (van Zee and Minstrell 1997; Fives and Alexander 2001; Hynd 2001). In the given context, persuasion refers to human communication that is designed to influence people's beliefs, values, or attitudes (Simon 1976).

Traditional methods of designing m-learning systems have focused on the tasks users are likely to complete as opposed to designing them to persuade the user to develop knowledge or to learn about topics. Online learning was originally created for impart knowledge, and storing and retrieving of data. In this paper, we argue that gamified m-learning arrangements should not only stimulate productivity and creative inquiry among learners (Johnson et al. 2013, Khaddage and Knezek 2012), m-learning systems should adopted persuasive roles as they have shifted to our everyday lives as a result of their ubiquity (Fogg 1999, 2003).

Successful m-learning systems allow the user to interact with the environment using mediating artifacts (Bishop 2005) which are conductors for action within these environments. Mediating artifacts in m-learning systems take many forms, e.g. text that offers the perceived affordance of clicking, icons that offer the perceived affordance of dragging etc. Khaddage and Lattemann (2015) suggest to use the concept of gamification to make m-learning systems more appealing to students.

Studies found that educators need to take into account the social and cultural background of learners, as well as their existing beliefs and personal goals in order to influence the way they understand and consider ideas and concepts. The importance of taking social and cultural background into account is even more apparent in m-learning systems, where learners are more likely to find persuasive material to be difficult to understand and the authors less credible (Long et al. 2001, Murphy et al. 2001).

Businesses have largely embraced gamification to design work incentive programs combined with mobile apps that engage employees through rewards and badges. Learning institutions are catching up. A growing number of educational institutions are currently experimenting with game integration via mobile apps for teaching and learning (Khaddage and Knezek 2012; Khaddage and Lattemann 2013) and there has been increased attention for gamification as a method for providing interactive and exciting content to learners (Kapp 2013).

4 Persuasive Technology and Design Patterns

Oinas-Kukkonen and Harjumaa (2008) define a persuasive system as “a computerized software or IS designed to reinforce, change or shape attitudes or behaviors or both without using coercion or deception.” Persuasive technology (Fogg 1999; Fogg 2003) applies elements of rhetoric and conditioning to influence behavior. Persuasive technologies are applied in various contexts, such as of websites (Gretzel and Fesenmaier 2007), recommender systems (Xiang and Fesenmaier 2006), social networking websites, mobile computing, and in the context of e-learning in health education to assist individuals who wanted to cease smoking (Escoffrey et al. 2004).

However, the application of persuasive communication in the design of e-learning, and in particular m-learning systems, has been somewhat limited, particularly because of problems with making mediating artifacts as persuasive to users as real-world equivalents (Long et al. 2001; Murphy 2003).

What distinguishes persuasive systems from other systems is that they are inherently and per definition transformative. Persuasive systems deliberately attempt to infuse a cognitive and/or an emotional change in the mental state of a user to transform the user's current cognitive state into another planned state. The focus of any persuasive system must be a

technology-mediated transformation of either attitudes or behaviors, including a transformation by bolstering or reinforcing existing attitudes or behaviors (Oinas-Kukkonen and Harjumaa 2008, 2009).

Fogg (2003) points out that through making suggestions at the opportune moment, a user can be persuaded that adopting a specific attitude or action will allow them to achieve their goals, even if this involves diverting from a pre-defined plan. Accordingly, computer systems and applications can influence human behavior by playing three different roles: **computers as a tool**, a **medium**, and a **social actor**. That is, technology can be used to increase working capability by making human activities easier or more efficient (e.g., math calculators), creating second-hand experiences, providing sensory information (e.g., virtual environment and simulation), and building relationships with counter users or even the systems (e.g., matchmaker web sites or digital pets).

Lehto and Oinas-Kukkonen (2011) point out that designing systems that aim at behavior change require a thorough understanding of the problem domain and the underpinning theories and strategies of persuasive systems design (PSD). PSD patterns (Oinas-Kukkonen 2010) reflect theories intended for behavior change and provide guidance for the implementation of systems that support behavior change (Gemert-Pijnen et al. 2013; Oinas-Kukkonen 2010; Wiafe et al. 2014). Oinas-Kukkonen and Harjumaa's (2009) categorize persuasion techniques according to following design principles based on aspects of human behavior which need to be recognized in order for persuasion to be effective:

- (1) *Primary task* - that supports the carrying out of a user's real-world activity and is comprised of reduction, tunneling, tailoring, personalization, self-monitoring, simulation and rehearsal.
- (2) *Dialogue support* - deals with degree of feedback and features that support interaction between the users and the system and is comprised of praise, rewards, reminders, suggestion, similarity, liking and social role.
- (3) *System credibility support* - deals with designing more credible and subsequently more persuasive systems and is comprised of trustworthiness, expertise, surface credibility, real-world feel, authority, and third-party endorsements.

5 Gamification

Education and the aim to change student's attitudes and behaviors through contextual information, advice and guidance are areas with high potential for the application of gamification, especially with the recent and rapid development of mobile apps that are creating an evolution in education (Gibson 2011; Lee and Hammer 2011). Applying game mechanics within mobile app can create competition among students and can lead students to take desired behaviors or actions (Cronk 2012). Hence, combining the idea of gamification with mobile apps can create a persuasive learning environment that fosters creativity among students (Landers and Callan 2011) and change student's attitudes and behaviors. Gamification is defined as the use of game thinking and game mechanics in a non-game context to engage users and solve problems (Deterding et al. 2011).

Gamified mobile apps use mechanics and dynamics from video games to cause a similar involvement in non-game environments (Wu 2012). Assuming that students like to play, but are confronted in their everyday life with non-motivational activities, gamification is a process to induce motivation and engagement into those activities (Khaddage and Lattemann 2015) and to persuade the learner.

Game mechanisms, such as rewarding badges and different states, providing game and information levels, granting points and bonuses, quests and challenges (Xu, 2012) motivate students to reaching given goals and managing their progress (Simoes et al. 2013).

In the following we present an innovative persuasive design pattern for mobile learning applications.

6 The proposed innovative persuasive design pattern

Persuasive design seeks to actively persuading the learner into engaging learning tasks and activities. Usually persuasive design emphasis on actively doing the task with enthusiasm, rather than feeling obliged to do it. Therefore the design should infuse learners with motivation in order to change their behavior. Bishop (2005) proposed a model for designing persuasive e-learning systems. The author describes the role of mediating artifacts in the persuasive design process. The proposed model focuses on 4 stages:

- Stage 1 – Identify learners’ Goals
- Stage 2 – Identify Information learners’ need to achieve goals
- Stage 3 – Identify mediating artifacts learners ‘need to achieve goals
- Stage 4 – Develop system and evaluate persuasiveness

To build a persuasive m-learning environment, we integrate Fogg’s Behavior Model (2007) (Figure 1), which focuses on three elements: Motivation, Ability and Trigger in Bishop’s model. All three elements in Fogg’s Behavior Model should converge at the same moment in order for a behavior to occur, and if a behavior does not occur, at least one of those three elements must be missing. This model has a high applicability in the case of a human-computer interaction, and in our case learning via a gamified mobile app.

Looking at Fogg’s Behavior Model, we believe that gamification offers the proper tools to generate positive change in students’ behavior, hence the application of this model can create more effective and engaging m-learning applications.

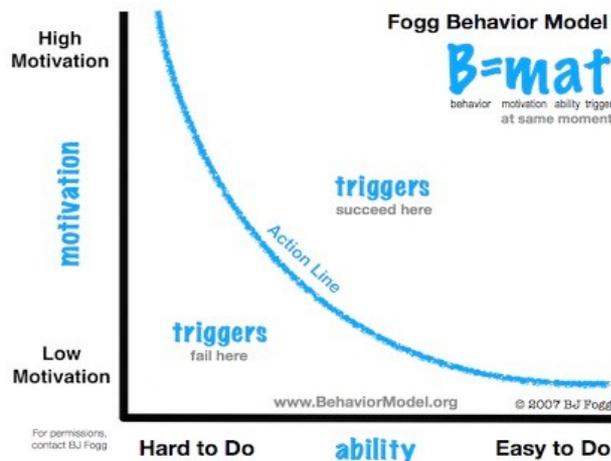


Figure. 1 Fogg’s Behavior Model (Fogg 2007)

Learning via games is not a new approach. There are at least three types of games used in education: the classic edu-tech games, games developed by students themselves like Scratch and the gamified courses on a web-based system, that is usually occur when adding game mechanics to existing learning applications (Corcoran 2010).

Table 1 shows required behaviours, goals and actions taken:

	Caring	Collaborative	Cordial	Challenging/competitive	Combative
Goals	Learners help each	Learners share their	Own non-conflicting	Learners share goals	Opposing goals

	other	own goals	goals		
Actions	Give each other advice, ideas and solace	Work together to achieve shared goals	Motivated actions	Work against each other to achieve own goals	Helping each other to complete goals

Tab. 1 **Learner’s behaviours, goals and actions**

Designers of app games usually seek to motivate behaviour change amongst users (Luarn and Lin 2005). In line with Bishop’s model Luarn and Lin (2005) state that the best persuasive design in a gamified mobile app is when the designers are able to understand the behaviour (stage one of Bishop’s model) that they want the learners to change (stage two of Bishop’s model) before they start working on the prototype design (stage 3 Bishop’s model), when those behaviours are identified then, persuasive design patterns are applied and integrated (stage 4 of Bishop’s model).

The following persuasive design patterns could be derived from Fogg’s Behavior Model to be applied in a pervasive m-learning system:

1. **Limited choices:** learners are more likely to make a choice when there are fewer options available to them on the app (criteria: easiness to do).
2. **Use colour and visual affirmation:** this is necessary in order to draw learners’ attentions to the key tasks you want them to do, and visual affirmation of what the learner has already done and what benefits he/she will be getting. This will motivate them further and encourage them to complete the allocated task to the end (criteria: high motivation and easiness to do).
3. **Maintain learners’ momentum:** provide learners with initial commitment so that they are committed to complete and accomplish the task, this could be achieved by generating a unique name/ nick name or any kind of identifier for each particular learner, then focus on the learner and what they are there to do (criteria: high motivation).
4. **Create a delight fun experience:** this will ensure that learners can always remember and respond to playful unexpected joy. This will hook them to the delighted learning experience via the gamified application (criteria: high motivation).

When persuasive design patterns are applied in a gamified m-learning environment, they may offer an appropriate challenge to engage learner to meeting those challenges. Challenges and game mechanisms approaches are exciting and fun, especially those that draw a balance between overwhelming and boring learning content and create “flow” (Csikszentmihalyi 2008). In order to keep learners in flow, they need to be given appropriate challenges in the gamified mobile learning app, hence this approach may provide a consistent and steady flow for the learners as they may find themselves constantly moving towards a higher level of complexity with in the particular learning game, requiring increasingly more difficult challenges to suit a growing skill level.

The learners remain the most important, especially when they download the gamified mobile learning app and start using it. The challenge that is usually faced is how to hold onto them and keep them hooked into the learning task for a long period of time. This is an ongoing engagement issue course designer are constantly dealing with, as engagement should be maintained amongst learners at all time, and for the duration of the course. There is no way to be able to retain learners on the longer term, without using persuasive design pattern. Apply persuasive design patterns to the design; let learners experience how great and engaging the content is, but if the content is disengaging and doesn’t provide real value

and challenging experience for learners the learner would not use it again. Therefore it is important that learning content via a gamified app as well as and learners goals need to be matched in order to achieve great outcome.

7 Conclusion and future research direction

Persuasive design patterns are everywhere instilling creativity and satisfaction and fundamental techniques. The focus should remain on the full learner journey from the beginning to the end. The primary goal of this paper is to introduce the concept of persuasive design patterns in gamified m-learning environment. Appropriate persuasive design patterns that could be integrated in a gamified m-learning environment are identified. Persuasive design in a gamified mobile learning environment is described and a persuasive set of design patterns appropriate to a gamified mobile environment is introduced.

By referring to former research, we answered the following research questions: What kind of persuasive design patterns could be applied to enhance learning and teaching applications via gamified mobile learning environments? Which persuasive design patterns support learning and assist students to attain an appropriate learning atmosphere and get students hooked to the learning task/activity?

This paper is considered as a first step towards introducing the concept of persuasive design patterns for gamified mobile learning environments. Further work is underway to validate this approach. More study is needed in order to conduct learners' evaluation in an actual gamified m-learning environment via an app.

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