GAMEDUCATION: Using Gamification Techniques to Engage Learners in Online Learning

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Abstract. Engaging learners long enough to see them through to the end of a course has become one of the most significant problems faced by e-learning developers. The lack of engagement in e-learning can be attributed to three main issues: interaction, challenge and context. Therefore, learning types with high level of interaction and challenge - such as game-based learning – have become widely used. In order to gain the power of games - represented by interaction, motivation, and challenge - e-learning developers started thinking of using game mechanics and dynamics to enhance e-Learning. Gamification of education is still a new trend of research and lacks frameworks and guidelines of how to develop 'gamified' learning tools enabling new forms of engaging learning. This paper reviews theories and research related to learner motivation and engagement. Moreover, it proposes using Gamification in the context of education thus to tackle the lack of learner's engagement.

Keywords: e-Learning, Gamification, Engagement, Motivation.

1   Introduction

Learner motivation and engagement has become a challenge to e-learning systems. Therefore, learning types with high level of interaction and challenge - such as game-based learning - have become widely used. The use of games technology for learning is not new and online games have been available for more than a decade. According to Kriz [1], interactive-learning environments foster knowledge transfer, skills and abilities improvement in general and social skills in particular. A variety of educational online games have become available to increase learners' motivation, support collaborative learning and games may foster students to gain knowledge [2].

Despite the benefits of game-based learning and serious games [3-8], the wider adoption of serious games in learning is faced by some challenges and barriers such as the large budget a game needs to be developed [9, 6], the lack of games content specifications thus to be reused in other learning scenarios [5], and the integration with the learning management systems to what and how to learn [10]. Therefore, researchers in domain of technology-enhanced learning started investigating the applicability of the so-called Gamification in designing learning tools and systems.

This paper sheds the light on the Gamification research field and gives insights from literature on learners' motivation and engagement. The rest of this paper is organized as follows: Section 2 discusses limitations and challenges for raising learner's motivation and engagement. Section 3 discusses Gamification of education GAMEDUCATION based on theories of social learning and motivation. Neverthe-

less, it provides a set of findings and recommendations for what does GAMEDUCATION mean and how online learning could be enhanced using Gamification. Section 5 provides conclusions and outlook.

2 Learner Motivation and Engagement in Technology-Enhanced Learning

Motivation is considered as essential factor for effective learning. Motivation for learning has been described as the 'engine' that drives teaching and learning [11]. Moreover, according to Bransford et al. [12] motivation affects the time and effort learners plan or consume to learn or to solve problems. Nevertheless, motivation is considered as an important outcome of education [11], thus teaching and learning activities should be carefully designed to promote motivation.

When e-learning first became popular in the early 1990's, cost effectiveness was promoted as its main advantage over traditional methods of instruction. CD-ROMs could be produced cheaply and distributed globally to cater for a high number of users. The introduction of the Internet increased the reach of e-learning systems and many developers rushed to embrace new emerging web technologies. Unfortunately many developers failed to maximize the full potential of such technologies and although they produced systems that appeared attractive, often the content was poor. On the other hand, many researchers argue that students must be meaningfully engaged in the learning resources for effective learning to occur. Engaging learners long enough to see them through to the end of a course has become one of the most significant problems faced by e-learning developers. This lack of engagement in electronic learning content can be attributed to three main issues: interaction, challenge and context (adapted form ALICE[1] project).

– **Interaction**. It is generally agreed that interactivity is a critical factor in the design of e-learning systems. Such interaction directly affects the learner's overall experience and provides motivation to continue in the learning process. Studies researching the effectiveness of e-learning systems highlight the need for immediate feedback, clear short-term goals and better "flow" in moving through the content. The inherent fixed structure of many e-learning systems often fails to provide adequate mechanisms to support interactivity between the user and the system. In many current cases the only interaction available to the learner is to click on the "next" button to step through the material presented.

– **Challenge**. Learners have indicated that unchallenging learning material fails to stimulate them, making the experience unattractive and discouraging progression. As a result, many are reluctant to repeat this experience. Some researchers suggest that effective learning takes place when there is tension between the learner's base knowledge and the gap between the knowledge and skill to be learned. Such tension fosters a sense of curiosity and/or challenge. Motivation can be further enhanced by

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[1] ALICE Project: www.aliceproject.eu, last visited March 10th 2013.

incorporating clear short-term goals and providing suitable feedback to encourage the learner to continue. Short-term goals help the learner break down a large task into smaller achievable chunks whilst the feedback gained through interaction helps the learner reflect on the learning process and lets them see the consequences of their actions.

– **Context**. Current e-learning design often fails to situate the learner within the context of their course of study and provide them with a sense of orientation. Students have stressed the importance of being able to appreciate the significance of their current progress in relation to the overall goal of the learning material and how their choices may have affected their progress.

The profile of the modern learner has changed in recent years. With the advent of the so-called "information age" there is an expectation that the workforce will adapt their skills or even change careers to keep in step with technological advancements [13]. This has led to a growing consensus that learning is a lifelong process with many returning to education to retrain. Nevertheless, since the early 1990's, the proliferation of technology means that students have grown up with computers, MP3 players, mobile phones and digital games [14]. The new learner has so different needs that have to be addressed if e-learning is to be successful. Those needs can be summarized as:

– **Empowerment**. The new learner expects to be in control of their learning experience while in a supportive, collaborative and simulative environment. Thus e-learning systems should promote self-directed learning. Unfortunately, many e-learning systems have a linear structure with a single path through the learning material. While this design is cost-effective, the lack of choice reduces control of the learning experience. Research suggests that having such control is more motivating. A suitable balance is required, however, as self-directed study requires high self-efficacy and vulnerable learners often lack the intrinsic motivation to manage their personal learning experience effectively.

– **Social Identity**. Although current e-learning systems allow learners to move at their own pace they isolate them from their peers participating in the same learning process. This inhibits the learning achieved through social interaction and collaboration, with some learners feeling "lost". Research indicates that a sense of belonging to a social group improves motivation and effective learning overall.

– **Authentic Learning Experience**. Learners expect the material to be linked to prior knowledge and be relevant to their everyday lives and careers. In short, the new learner is seeking an "authentic learning experience". Generally, learners are more engaged when they are participating in activities that they can relate directly to prior knowledge and make connections between what they are learning and the real world.

If such links are missing, learners are less inclined to participate in the learning process and may see it as pointless. For the new generation who are used to customizing their environment there needs to be flexibility in the order and way in which material is studied. Therefore, learning designers have started thinking and looking for tools and ideas to raise learners' engagement and motivation and to provide challenging, contextualized and highly interactive learning tools and objects. Among these ideas is to use the game design thinking in designing online learning.

3   GAMEDUCATION: GAMIFICATION of Technology-Enhanced Learning

Gamification is a new trend of research focusing on using game mechanics and dynamics in non-game contexts to stimulate desired behaviors. Gamification has shown its value in the domain of marketing in particular and other domains such as health, politics, and environment [15]. However, Gamification in education (GAMEDUCATION) aims at redesigning e-learning systems to utilize the benefits of game-based learning and serious games to motivate learners to learn better, further engage them, situate their learning, and to maintain their social identity. However, how to 'gamify' e-learning?

Apart from game-based learning, Gamification of education has little research [16]. The mechanics of the game are the actions, behaviors, and controls that are used to 'gamify' an activity in order to (a) stimulate specific emotions on the player (Emotional level), (b) encourage learners to explore, try, and experiment gamified learning setups (Cognition level), and maintain learners social identity through social spaces for learning (Social level), whereas game dynamics are the result of achievements, desires and motivations reflecting activities on those levels (see Table 1).

Table 1. Game mechanics and game dynamics (adapted from [15, 17])

Game Mechanics	Game Dynamics	Game Aesthetics
Points	Reward	Curiosity
Levels	Status	Satisfaction
Challenges	Achievement	Surprise
Virtual goods and spaces	Self-expression	Trust
Leaderboards	Competition	Envy
Gifts and charity	Altruism	Fun

The definition mentioned above highly depends on the MDA framework for game design [17]. MDA stands for Mechanics, Dynamics and Aesthetics as main elements to consider when it comes to design a game. Reference [18] proposes a more generic definition of Gamification as "the use of game design elements in non-game contexts". However, this definition and the MDA framework hold a design challenge of how to design interactions for game design elements that triggers users' desirable emotional responses in order to stimulate target behaviors. Thus, provides meaningful learning that overcomes the quoted problems and limitations in section 2.

3.1   Raising learner Motivation and Engagement using Gamification

Raising motivation and providing engaging learning is a major concern for TEL designers as discussed in section 2. This section sheds the light on some theories re-

lated to motivation and engagement and how those theories are applied to the domain of Gamification.

Among the motivation theories is the 'Flow' theory, - developed by Csikszent-mihalyi's in 1979 - is interested in how an intrinsically rewarding experience feels [19]. From his research and interviews, he has concluded that pure intrinsically motivated behaviors involve enjoyment, complete immersion in the activity, detailed focus, feelings of competence, and loss of conception of time. He stated that the enjoyment from the 'flow' experience further motivates the individual to seek additional challenges. This experience or 'flow' can only result from a situation where high challenges are matched with high skills. A skill/challenge imbalance leads to less than ideal emotional states: "*when challenge is higher than skill, anxiety will be experienced; when challenge is low and skills are high, boredom will result; when both skill and challenge are low, apathy will be experienced.*"

Most of us have had that "involved" moment happen, when we concentrated our attention so intensely on solving a problem, reading a book, climbing a mountain, on some task, that we lost track of time and when we became aware of our surroundings, few hours or more had passed by as if they were minutes. Such 'flow', according to Csikszentmihalyi [20] is "optimal experience" that leads to happiness and creativity. Flow is the state in which people are so involved in an activity that nothing else seems to matter; the experience is so enjoyable that people will do it even at great cost, for the sheer sake of doing it. If a task is not challenging enough, boredom sets in, while too challenging task leads to anxiety to happen, and both cases should be avoided. As one's skills increase, then the challenge must also increase for one to remain in a state of flow. Because flow is an enjoyable experience, one continues to increase the challenge level, and consequently continues to improve one's skills because doing so is necessary to stay in a flow state. A learning environment in which students are challenged at an appropriate level, which can produce flow, will be more productive.

Another motivation related model is the Fogg Behavior Model (FBM)[2] through which anticipated user behavior is controlled by three main factors: motivation, ability, and triggers. The FBM model argues that for a target behavior to happen, the user must have sufficient motivation, sufficient ability, and effective trigger. According to FBM, a trigger has different names: cue, prompt, call to action, request, and etc. Moreover, the model defines three types of triggers based on combinations of ability and motivation levels as: spark is a trigger that comes when a user has a high ability to do an action and low motivation to do it whereas the facilitator is associated to high motivation and low ability, and a signal trigger has high ability and high motivation in the same time. However, stimulating a desired behavior requires triggering the user to take an action in the right time when s/he has the sufficient ability and motivation.

Motivation to perform an action can be either intrinsic or extrinsic. Intrinsic motivation is usually happening when the behavior itself satisfies users, where extrinsic motivation is often derived by potential gains such as money, rewards, or praise [11]. The research of [21] shows that there is an evidence of the influence of intrinsic motivation on learners' engagement that leads to 'deep' learning through higher level

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[2] http://www.behaviormodel.org/

thinking skills and conceptual understanding. Moreover, Crooks [22] highlights the problems associated with extrinsic motivation as it leads to 'shallow' instead of 'deep' learning. The Self-Determination Theory (SDT) focuses on the degree to which an individual's behavior is self-motivated and self-determined. The theory examines the influence of extrinsic motives on the intrinsic ones for achieving target behaviors. For instance, in an analysis study for 128 studies related to motivation evaluation in education led to that mostly extrinsic motives – i.e. rewards – minimized the level of intrinsic motivations [23]. Nicholson [24] argues that the game design elements used to 'gamify' a service should be rewarding themselves without any need for extrinsic motives and rewards. Moreover, Nicholas accommodates the user-centered design theory in designing interactive objects that foster target behavior. Nevertheless, involving users in the creation and the customization of the game design elements used to 'gamify' a system enables them to self-determine which objects matches their interests.

In the same context, Zang [25] builds on the affordance theory – i.e. action properties for an object actor interaction - and argues that Information and Computer Technology (ICT) should be used based on a "motivational affordances". Motivational affordances deal with including only the objects properties that match the users' needs and interests. Deterding [26] goes further and proposes a conceptual model for designing meaningful game elements for Gamification purposes. The model builds on the SDT and implements the motivational affordances theory in order to achieve meaningful Gamification through extending them with situation and context. Deterding also argues that users are more interested and engaged when they interact with elements that match their interest and fit with their context and background.

Focusing on learners' social identity and social style, it's important to relate our discussion to the theories behind social learning. Bandura's social learning theory (SLT) [27] argues that learning occurs due to interaction with others - i.e., in a social context. Behavior, attitudes, and emotional reactions are developed by observing, imitating, and modeling the behavior of other people. In particular, behavior is more likely to be acquired when the result of this behavior is desirable. Accordingly, there are four processes that underline social learning[3]: attention, retention, motor reproduction, and motivation. Therefore, one prerequisite of learning is that attention has to be paid to an object or task. Attention is varied by several factors like individual's characteristics (e.g. sensory capacities or arousal level) or complexity. Retention means that it is necessary to remember for what attention was paid. Reproduction means that the image has to be reproduced, and motivation means that there must be a good reason to imitate the image. Another theory is the social development theory [28] which argues that social interaction plays a fundamental role in the development of cognition. Moreover, Vygotsky argues that the potential for cognitive development depends upon the "zone of proximal development" (ZPD): a level of development attained when learners engage in social behavior. Full development of the ZPD depends upon full social interaction. The range of skill that can be developed with adult guidance or peer collaboration exceeds what can be attained alone.

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[3] http://www.learning-theories.com

Social Learning plays major role in defining interactions between objects and avatars in 3D virtual words and serious games. For instance, Smith and Berge [29] investigated the influence of Bandura's SLT in SecondLife[4]. SecondLife is a three-dimensional, virtual world where users are represented by avatars. Smith and Berge suggested that the proposed components of SLT (observing, imitating, and modeling) can also be observed in virtual worlds and that SecondLife is "a great example of social learning theory in action, although there are some components that cannot be satisfied in-world". For instance, it is not possible to observe attitudes and emotional actions in SecondLife. However, cooperation in such learning communities is influenced by the characteristics of its members [30]. Moreover, for emerging a social space, three factors that should be considered: First, there should be *continuity*, meaning that there should be a continuity of contact, members can be recognized, and a historical record of actions. Second, a *community* should be *populated heterogeneously* with all types of members to ensure liveliness of the community. Third, *clear boundaries* and set of rules are required that can be monitored and sanctioned. Such boundaries facilitate cooperation.

Pink [31] defines three main factors for task-performance support: *autonomy*, *mastery*, and *purpose*. In the context of GAMEDUCATION, Pink theory can be applied to education through empowering learners with highly interactive and engaging tools that (a) support learners to be self-directed (autonomy), (b) maintain the learners desire to learn and achieve better results (mastery), and (c) align learning objectives to learner's purpose of learning which in other words aligns the self-directed learning objectives with the curricula objectives.

Based on that, how effectively game design elements can be used to 'gamify' non-game contexts in general and TEL in particular. Apparently Gamification goes beyond using game design elements in non-game contexts to more considering how to apply game design elements in non-game contexts while matching the user interest and background and providing situated and challenging elements. Moreover, when it comes to apply Gamification to TEL, alignment with instruction and learning should be considered. Therefore, using ICT in education requires instructional affordances and learning affordances in addition to motivational affordances. This leads to a question of to what extent available/potential Gamification-based learning platforms use the instructional, learning, and motivational affordances.

Researchers in the domain of Gamification are dealing with similar challenges on how to use game design elements in an effective way to provide meaningful Gamification. For instance, Nicholson [24] proposes a user-centered theoretical framework for meaningful Gamification through which he is dealing with the user motivation problems. More precisely, the framework tries to solve the problem of negative influence of extrinsic motivation – mainly rewards – on users' intrinsic motivation. The framework leads to define meaningful Gamification as "the integration of user-centered game design elements into non-game contexts". Nicholson argues that involving end users in the creation and customization of the 'gamified' system enables

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[4] http://secondlife.com

them to select and create meaningful game elements that go in line with their needs and interests.
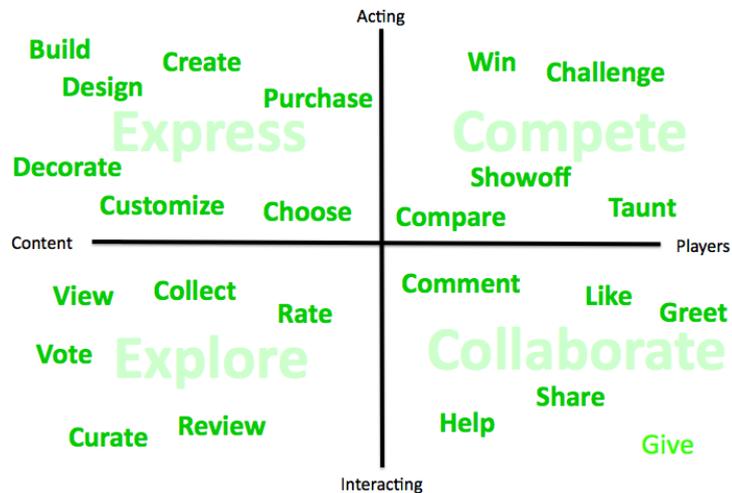

Fig. 1. Kim's social engagement verbs (Kim's Blog: http://amyjokim.com).

Kim[5] discusses how to achieve sustainable engagement in Gamification systems. Kim focuses on social engagement form a viewpoint of a game designer by first knowing who play is and what is their social style. Therefore, Kim has adapted Bartle's MUD player types [32] with more emphasis on social styles of the players into *Compete* (similar to Bartle's Achiever), *Collaborate* (similar to Bartle's Socializer), *Explore* (identical to Bartle's Explorer), and *Express* (a replacement for Bartle's Killer). Nevertheless, she uses this adaptation to collect social engagement verbs that can be allocated to each on these four types of players' social styles and used to design Gamification systems (see Fig. 1). Kim also recommends using the PERMA model in designing the engagement loops of the system. The PERMA Model was developed by Martin Seligman in 2011 and aims at supporting human well-being. PERMA stands for the first letters of the model main components as: *Positive Emotion* (experiencing positive emotions such as pleasure, curiosity, etc.), *Engagement /Flow* (moments of consciously involvement in activities), *Positive Relationships* (enjoyable and supportive interactions with others), *Meaning* (creating purposeful narrative), and *Accomplishment/Achievement* (using core values to achieve goals). Kim's work and models hold great promises when it comes to maintain learner social identity in learning environments.

3.2   Findings and Recommendations

Applying Gamification to e-education requires alignment to instruction and learning. Moreover, more focus on learners' social identities and social styles should be

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5   Smart Gamification, 2011 , presentation, http://www.slideshare.net/amyjokim

taken into account. In order to provide meaningful Gamification in e-education, GAMEDUCATION proposes in addition to situated motivational affordances [26], instructional affordances, learning affordances, and social affordances. Learning affordances comprise the properties of an object that determine whether and how it can support the activity learning type – e.g. collaborative learning, self-directed learning, etc. Instructional affordances include the properties of an object that determine whether and how it can support the instructional design – i.e. e-learning and m-learning. Finally, social affordances include the properties of an object that determine whether and how it can support in maintaining learners social identity and accommodate their social styles. If TEL designers will be able to design learning objects and thus learning tools in a way that comprise learner needs, interests, and background, moreover to be applied for different learning types and to support different learning approaches then they can contribute to the overcoming of the quoted limitations in TEL and thus provide more engaged learning.

Nowadays no implementation, except for some experiments and attempts limited to single aspects of game elements, is able to offer a complete methodological-technological-industrial solution covering the power of games in designing and providing e-learning. Few examples of learning platforms can be found in which game mechanics and dynamics are used to 'gamify' learning. An example of this approach is the Khan Academy[6], a non-profit project providing free materials and resources with the goal of a better education for all. The project's platform includes several game mechanics like achievement badges and points. It also provides up-to-date statistics of students' progress. Moreover, delivered exercises difficulty and challenge cope with the learner skill level as discussed in the flow theory before. Another example is schoooools.com, a K-6 social learning environment which is enhanced to encompass games elements based on the social Gamification framework [33].

Examples of using achievements and badges to leverage user behavior on online communities such as the Q&A website StackOverflow[7] can be found in [33, 33, 35, 36]. Results show that using game dynamics - achievement and badges - increased users' participation and engagement. Similarly, the ResearchGate[8] website where users are assigned a score based on their added publications, Q&A activities, and followers. ResearchGate is a social networking site for scientists and researchers to share papers, ask and answer questions, and find collaborators. User activities on ResearchGate can be rated by the research community which then affects ther ResearchGate score.

Badges have also a positive impact on learners' engagement in online learning [37, 38, 39, 40], the research demonstrate how badges and rewards enhanced learners' outcome and raised their engagement.

Consequently, findings form literature on building learning environments that are engaging can be summarized as follows:

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[6] http://www.khanacademy.org
[7] StackOverflow provides Q&A support for the programmers: http://stackoverflow.com/
[8] www.researchgate.net

- Personalized learner profile, by which students are enabled to customize their avatars based on their personal preferences, belong to social space, and be part of groups. Moreover, the profile allows notifications access and maintains privacy.
- Design learning as levels and phases enabling multiple learning paths, repeated experimentation, problems and exercises. Learning tasks, problems and exercises should be adapted to learner skill level and knowledge state. Once the learner finishes an exercise s/he accumulates points which enable the student to achieve a new level. This achievement should be reflected on his status and updates the rank on the leaderboard which is shared with his learning social space.
- Students should receive rapid feedback cycles which scaffold their learning progress and updates their progression bars in the learning social space. Social recognition and rewards may motivate students, engage them, and improve their social and learning skills.
- Complex learning tasks should be broken into simple tasks, the tasks difficulty should be increased to cope with the learner skill level thus to improve learner expectations on completing the task successfully. Moreover, the learning task should be designed to allow different paths to success. This enables the learner to define personal goals and objectives and select and tries several paths to reach the final goal and achieve her/his personal learning goals. Once the learner accomplishes a complex learning task the system - could be teacher, peers - provides bonuses.
- The system should enable social spaces and stimulates desired behavior and social interaction - like supporting peers, peer-review, providing comments, discussion posts, organizing activity, etc. - by offering badges.
- The system should offer the possibility to exchange points and badges with virtual goods or even receive tickets, trips, or registration discounts - could be tuition fees discount. This will stimulate desired behaviors and more engage learners.
- Learners should be empowered to play different roles and participate in the design of the learning activity as well as assessment forms.
- Learning content and tools should be highly interactive and provides challenging learning tasks that adapts to the learner skill and knowledge state.

4   Conclusion and Outlook

Gamification is a new trend of research which refers to the use of game mechanics and dynamics in non-game contexts to stimulate desired behaviors [16]. Gamification of education (GAMEDUCATION) aims at redesigning e-learning systems to utilize the benefits game design elements in motivating learners to learn better, further engage them, situate their learning, and to maintain their social identity. However, applying Gamification to e-education goes beyond using game design elements in e-education and requires alignment to instruction and learning. Moreover, more focus on learner's social identities and social styles should be considered. Therefore, in order to provide meaningful Gamification in e-education, GAMEDUCATION proposes in addition to situated motivational affordances [26] instructional affordances, learning affordances, and social affordances. More precisely, GAMEDUCATION

deals with including only the learning objects properties that match the users' needs and interests, situate their learning, and maintain their social identity.

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