kriativ.tech

Edição Nº 8 – 31 de Julho de 2020
ISSN Print: 1646-9976 | ISSN Online: 2184-223X |
http://www.kriativ-tech.com
DOI: 10.31112/kriativ-tech-2020-06-32

Gamification Mechanisms for Online Learning

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Abstract: *Gamification is the adoption of game elements in non-gaming contexts. While it has proven its success in educational settings, online learning presents a set of characteristics one must consider. This article discusses the particularities of online learning and the underlying restrictions of Student-Student Interaction. It presents a set of activities derived from state-of-the-art literature on online learning and gamification.*

Keywords: *Gamification, Online Learning, Student Engagement, Student-Student Interaction*

I. Introduction

Gamification consists of adopting game elements in non-gaming contexts [30,2]. In fact, games can readily provide information within context while easing the impact of failure. A well-designed game is a good motivator by nature, as it clearly defines goals for the player and a sense of reward and fulfilment when these are attained, encouraging persistence and endurance.
The use of gamification thus motivates users to adopt new behaviours, such as learning new skills or improving their health, work or lifestyle.

Education is of utmost importance to modern society and many efforts have been applied to improve its effectiveness and availability. In his book, Lee Sheldon [27] describes how a conventional learning experience can be designed as a game without resorting to technology, to engage students and make classes more fun and exciting. While traditional teaching techniques rely on oral lectures, books and written exercises, technological advancements brought new possibilities, such as video games. The latter reported significant improvements in student understanding, diligence and motivation [22, 31, 20, 18, 10, 23]. Not only can games deliver information on demand and within context, but their design can also be adapted to prevent boredom or frustration.

Games have long been considered good learning tools and their usage in education has been studied for more than a decade. In fact, researchers and educators have thoroughly studied the effort and resilience of gamers when playing games, and how these can improve learning [14]. Games have indeed been used to educate with success [15, 28], with documented improvements in learning outcomes, motivation and diligence in different academic areas.

Research shows that games can both be used to engage students and increase their activity and learning outcomes, at diverse academic levels, ranging from grade school [21] to college [32], and in diverse areas of knowledge, such as mathematics [32], programming [11, 34], or physics [34]. Drawing on these pedagogical benefits, gamification was adopted in education to engage learners, with prominent examples being Khan Academy[1] and Codecademy[2].

In terms of game elements applied to non-gamified processes, some of the most common are: *experience points* and *levels*, mainly for feedback and keeping track of progress; *challenges* or *quests*, with clearly defined tasks and goals, providing progress assessment and preparing learners for more complex tasks; *badges*, collectible artefacts that are intended to improve user motivation by appealing to their natural desire to collect; and *leaderboards*, which spur competitiveness by encouraging users to

[1] https://www.khanacademy.org/

[2] https://www.codecademy.com/

continually strive to achieve a higher ranking [24, 19, 26, 7, 13, 16].

As a matter of fact, even though gamification of education is a relatively recent subject, research shows promising results. Pioneer studies already demonstrated that gamification may potentially increase student activity [25] and performance [35], mainly in blended learning contexts. In an online learning setting, it is of paramount importance to understand the underlying restrictions and implications to successfully design a gamified course.

In this article, we present the use of gamification in fully online learning settings. We discuss the context of Online Learning and the importance of Student-Student Interaction, while presenting a set of activities that help overcome the challenges associated with the restrictions of this learning method. We then discuss the relevance of using gamification in online learning and the activities that have shown promise so far. We finalize by discussing the potential of future gamified learning experiences in fully Online Learning settings.

II. Student-Student Interaction in Online Learning Settings

Terry Anderson's Interaction Equivalency Theorem [1] states that deep and meaningful formal learning is supported whenever one of the following three forms of interaction exist: student–teacher, student-student, student-content.

Student-student interaction, which is the focus of this paper, is crucial in any course [29]. In a classroom setting, it happens naturally. In an online setting, instructors need to foster student-to-student interaction, but it may require a careful course design.

Participation and collaboration in fact leverage online learning [29], making it possible for participants to be involved in a sense of community.

However, often, students do not see the value in interacting with peers. It is thus important that the instructor provides extrinsic motivation, such as points or badges [8].

One important way to improve student-student interaction is through group work. Research has shown that meaningful group work can have a positive impact on student outcomes [17]. Not only do groups aid in building a learning community, avoiding the feeling of isolation frequently associated with online learning, but they do also provide the opportunity to apply concepts and theories, while allowing students to develop relevant skills that will probably be useful in their professional lives [17].

Besides icebreaker activities that allow participants to get to know their peers, such as post cards, study photos or "why I am here" discussions [33], some activities that promote learning and team development are: (i) charter development, (ii) project teams; (iii) case studies; (iv) simulations and role playing; (v) audio or video analysis; (vi) debates and negotiations [33].

In fact, student-student interaction seems to be crucial in online or blended learning, making use of technologies that are nowadays available for learning communities, such as online forums, blogs and wikis. Gamification mechanisms can leverage these processes and provide the opportunity for students to be more engaged and successful in learning.

III. Gamification in Online Learning

Discussion *fora* are one of the most common and are nowadays part of virtually all online or blended courses [29]. Online *fora* enable not only ice-breaking activities (such as student introduction, "why I am here" discussions) but also several other activities, such as theoretical discussions and debates. Definitely, *fora* cannot be considered gamified experiences. However, if we take discussions one step further and imbue them with gamification mechanisms, such as awards for participation, students will probably become more engaged. Moreover, if these awards grant badges, leveraging on our intrinsic need for collection [25], the potential will increase even more.

Several mechanisms may be successfully implemented in online learning. Two instances of such mechanisms are *guilds* (groups of students) and *quests* [6].

Effectively, in recent work, a blended university course has taken advantage of both mechanisms to promote student-student interaction over several years, with promising results [3, 4, 5, 6]. Here, the *guilds* consist of two achievements to encourage collaboration. While the *Guild Warrior* achievement is awarded to the whole group of students if all had above 80% in a lab assessment, the *Guild Master* is awarded to student groups with the best score in lab assessments.

Considering the importance of group work in online learning [17], *guilds* present the potential to improve students' sense of belonging and, consequently, course engagement which will eventually lead to higher grades and increased student satisfaction.

One of the principles that guide game design is *flow*, the sensation of influencing activity in the game [9, 12] while avoiding both boredom and frustration simultaneously. A *quest* was designed to promote *flow* and, at the same time, to encourage students to collaborate towards a common goal. It is a time-limited activity that requires students to complete specific tasks, consisting of an online riddle where participants start from a webpage with some sort of multimedia content, which they had to manipulate to find the URL for the next clue of the riddle, leading them to the next level. The amount of awarded grade points is proportional to the quest level reached (from a total of 20). To encourage participation, students must contribute at least once to earn the grade points, but a single student can never post twice in a row. Contributions are posted in the forums and rated by faculty. The more students participate and the further ahead they get, the more grade points all earn [6].

While this element solely relies on online mechanisms (web pages, fora), it may be directly adapted to an online course. Moreover, encouraging students to collaborate is of utmost importance [29] and a quest, designed in such a way, may in fact encourage collaboration. One important aspect to consider is the weight of the quest in the final grade. This will be the decisive feature in whether students do in fact participate, while not feeling unreasonably pressured to do so.

Other game mechanisms may be successfully implemented. For instance, in [6], the authors created the *AvatarWorld*, which consists of a 2.5D virtual world that evolves and grows as students earn grade points. Students are represented by an avatar that they can use to explore the world. These avatars may be customized with clothing items and handheld objects, which are unlocked when students acquire course badges. As a means for additional interaction, students may create custom content for the *AvatarWorld*, such as buildings and equipment items, using tools and techniques introduced in class.

The fact that they consist of visual representations makes virtual worlds a promising option for fully online settings, given that it provides the potential to aid learners in visualizing the outcome of their actions, hence enhancing *flow* and, consequently, student engagement.

IV. Conclusion

Gamification has shown success in different settings, ranging from lifestyle improvement to health and education. The latter has gained importance over the years. With the growth of online learning communities, effective mechanisms that allow students master their studies are crucial. In this paper, we discussed the particularities of online learning and adequate activities. We then presented gamification mechanisms that are compatible with these activities, derived from state-of-the art literature, and discussed their potential in fully online learning settings.

In fact, fully online educational settings may lead students to a decreased sense of belonging and even remoteness. However, leveraging student-student interaction with adequate strategies may overcome this challenge and have a high impact in online education, resulting in improved learning, higher grades and a more gratifying, engaging experience.

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