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Elements of gamification in virtual learning environments: A systematic review
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Abstract
Information technologies have introduced several changes in teaching and learning environments. In this scenario, the gamification technique emerges as a promising approach, considering the impact on the students' motivation and appealing to their participation. This paper describes a systematic review addressing gamification in virtual learning environments (VLE), presenting an overview on how gamification has been applied in these scenarios. This review was based on papers published in highly scored journals in the field of computers in education. The papers were selected according to the gamification theme, and the content was analyzed and a state of the art built, according to the retrieved qualitative data. The results seem to reveal that there are significant gains derived from the adoption of gamification in VLE. However, some gains are not unanimous and it depends on how the elements are applied. This paper also suggests a basis for future work aiming at applying gamification in a VLE. © 2018, Springer International Publishing AG.

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Elements of Gamification in Virtual Learning Environments

A Systematic Review

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Abstract— Information technologies have introduced several changes in teaching and learning environments. In this scenario, the gamification technique emerges as a promissing approach, considering the impact on the students' motivation and appealing to their participation. This paper describes a systematic review addressing gamification in virtual learning environments (VLE), presenting an overview on how gamification has been applied in these scenarios. This review was based on papers published in highly scored journals in the field of computers in education. The papers were selected according to the gamification theme, and the content was analyzed and a state of the art built, according to the retrieved qualitative data. The results seem to reveal that there are significant gains derived from the adoption of gamification in VLE. However, some gains are not unanimous and it depends on how the elements are applied. This paper also suggests a basis for future work aiming at applying gamification in a VLE.

Keywords - Gamification, Virtual Learning Environments, Systematic Review

1 Introduction

Nowadays there are many trends in Information and Communication Technologies (ICT) that lead us to a cultural change. Some authors suggest that we live in a digital culture. New generations were already born in this digital world, sometimes called digital natives, since they have spent their lives surrounded by computers, videogames, cell phones and have different ways to learn, and forcefully resist using the old method [1].

Traditional teaching and learning methods are challenging to digital natives, in the sense that the absence of technology undermines the students' motivation and emotional engagement [2].

To overcome this gap, games emerge as an alternative way of combining technology and content in a playful result, that enhances emotional engagement. Gamification extends this concept by adopting gaming elements and mechanics in non-game contexts [2].

There are many efforts to apply gamification in education in order to increase the engagement of students. Usually, it is associated to a platform or a virtual learning environment to provide a common environment to students as well as a record of the students' progress. Nevertheless, there are issues that need to be addressed in order to apply gamification in learning environments. Not all elements are successfully applied and they should not be used blindly, just because they are trending. The elements should be carefully studied, understood and their application justified and implemented with the students' participation.

This paper presents a systematic review that was guided to identify and analyze gamification elements applied in virtual learning environments. This review also extracts results and considerations toward these applications. In this scenario, it is possible to observe the gamification elements in evidence, and present their outcomes when applied.

2 Theoretical Background

Deterding states that "gamification is the use of game design elements in non-game contexts" [3]. The elements of a game can be defined as a toolbox, where there are tools to perform different actions [4]. Then, game design elements wrap up these tools into a systematic and artistic design to achieve a predefined goal or objective. Finally, non-game contexts represent the use of games for other purposes than their normal expected use for entertainment [3]. So, this use must be intentional and responsible going beyond fun and entertainment.

Several researches recognize gamification as a mean to increase motivation and engagement [3]. Achieving user engagement reflects on more effort learning [5]. This can be useful in educational environments drawing attention towards a topic or subject, through untraditional approaches.

However, applying gamification in educational environments is not creating or playing a game. Instead, it should be considered as an incentive to change behavior

within the learning outcomes and the pedagogical objectives, embedding game elements to foster engagement [6]. Moreover, if students are found to improve with such gamified approaches, the school and teaching processes should adapt and respond properly [7].

As a result, gamification is presented as an important alternative for scenarios targeting digital natives. It is possible to create engagement, obtaining numerous gains benefiting student's motivation on knowledge construction [8].

In parallel, Virtual Learning Environments integrate technology with education, making learning content and experiences available through the Internet [9]. However, some researchers suggest that the change in format is seldom motivating [10] [11].

In order to address this issue, there have been some efforts integrating VLE with gamification. This way supports educational theories, which can be implemented on the VLE, but also to proceed to engage students with gamification theories.

3 Methodology

The main research questions in this review are to assess which gamification elements are used in virtual learning environments and what is their contribution. For that, a through literature review was made.

The extraction from the literature of gamification elements usage in Virtual Learning Environments, started with a systematic literature review. This method can identify, evaluate and interpret in the available research those relevant to a particular phenomenon of interest [12] [13].

A systematic review involves several discrete activities in three main phases: planning, conducting and reporting the review [12].

The stages associated with planning are: a) identification of the need for a review; and b) development of a review protocol. The stages associated with conducting the review are: a) identification of research; b) selection of primary studies; c) assess the quality of the study; d) data extraction & monitoring; and d) data synthesis. Finally, the reporting of the review stage is a single stage phase [12]. The phases in systematic review are presented below.

3.1 Planning the Review

This systematic review arises from the need to analyse existing papers focusing on VLE with gamification elements, to draw more general conclusions about the combination of these aspects.

3.2 Conducting the Review

Identification of Research: The source of this research was journals which fit into three selection criteria: high quality journal; learning as primary field; computers in education as secondary field. The journal search was conducted through CAPES platform, a Brazilian organization for scientific dissemination. This platform classifies

journals in seven quality scores: A1 (Higher); A2; B1; B2; B3; B4; C (Lower). In this paper, the levels A1 and A2 were used as the quality parameter and learning as primary field. Within the primary result set each journal was analyzed to identify the secondary field. The selected journals are presented in Table 1.

Table 1. Selected journals to this review.

ISSN	Journal	Short Name
1539-3100	International Journal of Distance Education Technologies	IJDET
1055-8896	Journal of Educational Multimedia and Hypermedia	JEMH
1539-3585	Journal of Information Technology Education	JITE
1059-0145	Journal of Science Education and Technology	JSET
0360-1315	Computers & Education	C&E
2151-4755	Creative Education	CE
1695-288X	Revista Latinoamericana de Tecnología Educativa	RLTE

Study Selection: Within the selected journals, a search was conducted to select the studies which presented the word “gamification” in their content. Given the fact that gamification in educational environments is a recent theme, all years were covered in this search. The search returned 41 papers, structured by journal (Table 2).

Table 2. Total papers collected in primary search.

Journal	Number of papers
Computers & Education	31
Creative Education	7
International Journal of Distance Education Technologies	3
Revista Latinoamericana de Tecnología Educativa	0
Journal of Educational Multimedia and Hypermedia	0
Journal of Information Technology Education	0
Journal of Science Education and Technology	0

Study quality assessment: In addition to the general inclusion and exclusion criteria and the quality of primary studies, it is also necessary to look for the path to the answer to the main research question. The search criteria were very broad and many of the results were not useful to answer the research question.

Among the 41 papers, an additional step was performed to select the ones more useful to answer the research question. Papers that have no gamification applied in virtual learning environments have been removed from the results set (Table 3).

Data extraction & monitoring: This step defines all the information collected from papers to address this review question. This review proposes to identify trends in gamification applied to virtual learning environments. Therefore, to search for this evidence, the data extracted from papers is: a) gamification elements; b) their effects on the VLE.

Table 3. Selected papers

Index	Title
P1	Gamifying learning experiences: Practical implications and outcomes
P2	Leaderboards in a virtual classroom: A test of stereotype threat and social comparison explanations for women's math performance
P3	A multilevel analysis of the effects of external rewards on elementary students' motivation, engagement and learning in an educational game
P4	Gamification in assessment: Do points affect test performance?
P5	Usage of a mobile social learning platform with virtual badges in a primary school
P6	Digital badges in afterschool learning: Documenting the perspectives and experiences of students and educators
P7	Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance
P8	On the effectiveness of game-like and social approaches in learning: Comparing educational gaming, gamification & social networking
P9	Engaging Asian students through game mechanics: Findings from two experiment studies
P10	Cooperation begins: Encouraging critical thinking skills through cooperative reciprocity using a mobile learning game
P11	Individualising gamification: An investigation of the impact of learning styles and personality traits on the efficacy of gamification using a prediction market
P12	Open badges in online learning environments: Peer feedback and formative assessment as an engagement intervention for promoting agency
P13	Motivation Strategy Using Gamification
P14	Adaptive Ecosystem - Integrated Technology into the Curriculum

Data synthesis: The final stage for conducting the review activity involves collating and summarizing the results of the included studies. To this review the synthesis is descriptive (non-quantitative), however it is possible to complement with a quantitative summary.

Werbach identifies a list of elements that can be used to operationalize gamification: achievements; avatars; badges; boss fights; collections; combat; content unlocking; gifting; leaderboards; levels; points; quests; social graphs; teams; and virtual goods [14]. This list was used as a starting point to analyze the selected papers. The results of the reporting the review activity are shown in the next sections.

4 Results

This stage identifies whether gamification elements are used in virtual learning environment, their focus and goals.

Avatars: A visual representation of a player's character. This element is used in most cases as an icon or figure that users are able to insert in order to represent themselves. Therefore, avatars in a game or digital world is a virtual representation of the player, it may take a 3D form.

P2 and P3 papers represents a player's avatars in a 3D form (Fig. 1a), while P1, P5, P8 and P11 only allow users to insert static images to represent themselves in the environment.

Badges: A visual representation of a reward. Badges reflect the player's actions and contributions in an environment, for example, badges related to whether they were good commenters or questioners [15]. This element is presented in most of the papers: P1, P3, P5, P6, P7, P8, P9, P11, P12. Fig. 1b shows this element in use.

This element is also connected with Collections element, representing a set of related badges in which participants are able to being recognized by their performance through this collection. Collection element was seen in P3, P5 and P11.

Fig. 1. a) Avatar in a 3D form - P2; b) Badges - P1.

Leaderboards: A visual comparison of players' development or achievement. With this element, the progress of the user is public recognized and users are able to compare themselves with other colleagues [16].

This element is presented in papers: P1, P2, P3, P7, P8 and P11. Fig. 2a shows this element in use.

Levels: Based on player expertise the game increases difficulty. This element also represents the sequence of activities that the users need to perform [17]. It can be represented in different forms, e. g. avatar evolution, progress bar, pathways.

This element is presented in papers P3, P5, P8, P9, P13 and P14. Fig. 2b shows the level element applied to a pathway.

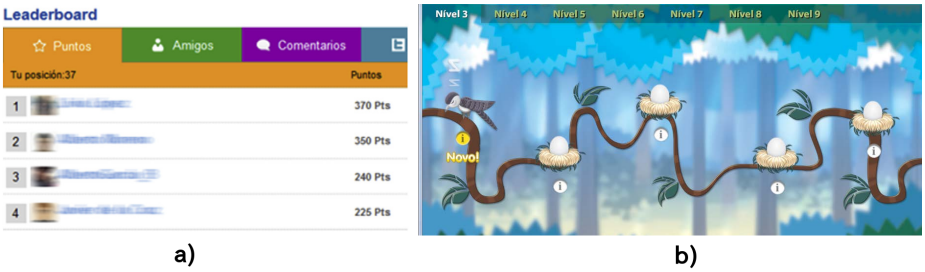

Fig. 2. a) Leaderboard - P8; b) Levels - P14.

Points: Numeric value regarding players' performance on activities. A classic element of games points reveals a numeric value that represents user's progression in the game [5]. This element is presented in papers: P1, P2, P3, P4, P5, P8, P9 and P14. Fig. 3a shows this element in use in an assessment.

Social Graphs: Social networks enabled with gamified activity. The users social integration is also a classic element of games. This element brings together gamification and social networking to create compelled socially-driven user experiences.

Many papers that allow social contact between users, e. g. chat. Yet, is explicitly presented in papers: P5, P8 and P10. Fig. 3b shows this element in use.

Teams: Group of players collaborating to solve a question or an activity. This element encourages learners to work together to solve problems, to see others perspectives and cooperatively find creative and critical solutions. Teams element is presented in papers: P5, P8, P10 and P14. Fig. 4 shows this element in use.

a) b)

Fig. 3. a) Points in a mathematic assessment – P4; b) Users update in a social platform – P5.

Fig. 4. Users collaborating in a 5-stage task (P10)

Virtual Goods: A reward with perceived value within the game. This element reward a user's action or behavior. This virtual good can be traded into benefits inside the environment. This element is presented in papers P7 and P11.

The Table 4 gathers the gamification elements used in each analyzed paper.

5 Discussion

To complete the report & review stage of the systematic review, some conclusions were drawn from the results and presented below.

With insertion in most of the papers, badges are presented as a prominent gamification element, used primarily to reward the users' actions and contributions in an environment [15].

In most of the papers this element achieves good results, although problems may occur when badges are the only gamification element in the virtual environment, as it

Table 4. Gamification elements in papers

Papers / Elements	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13	P 14
Badges	■		■		■	■	■	■	■		■	■		
Points	■	■	■	■	■			■	■					■
Leaderboard	■	■	■				■	■			■			
Level			■		■			■	■				■	
Avatar image	■				■			■			■			
Avatar in 3D		■	■										■	
Teams					■			■		■				■
Social Graph					■			■		■				
Virtual Goods							■				■			

happens in P6 and P12. An isolated element may fail to develop the idea of gamification, depending on the way it was used and conveyed. Sometimes, it should be used with companion elements, for a more substantial experience [18].

Another issue is that badges should not be used as a single, explicit reward, risking to undermine the students' motivation by drawing the attention only to the reward. The environment has to maintain pedagogical objectives and badges must lead students to it [19].

Points are the second element with higher insertion among the analyzed papers and it was well accepted among them. From a theoretical perspective, points provide performance feedback for students especially when a task is succeeded.

Although the papers have shown that it is not clear whether students understand the objective of the points element, they can be seen as a piece of information about a task development, guiding the students' attention to the task, or can be seen as a reward for good performance, drawing the attention to the user [20].

When VLEs draw the attention to the user, the environment loses their pedagogical objective, limiting the objective to earning points, as seen in P4.

However, most of the papers has shown that it can be used to represent a user progression. Thus, merging points with levels may be considered as an important feedback mechanism, responding to an action or activity. Points and levels show good results when used as feedback progression providers.

Mainly connected to points or badges, leaderboards are another frequent element observed in papers. Leaderboards produce different opinions in virtual learning environments. Some authors, for instance P1 and P7, suggest that leaderboards guide users to an explicit social comparison leading to competition and undermining the students' performance and their cooperation [21]. While others suggest that it promotes motivation due to the public recognition progress in students [16].

Although it is unclear to suggest the viability of this element in learning environments, there are a higher number of papers that imply negative effects due its insertion.

Level element is also connected with the students' correct sequence of activities and it is also considered as an important element of game mechanics [17]. It can have several design layouts and different forms of representation, e. g. evolution of a badge or character, progress bar, unlock achievements, collectables.

As previously mentioned, when combined with points, this can produce good results, as seen in P3, P5, P8 and P9.

The avatar element is a virtual representation for a player. Many papers have used avatar as an image or user photo; yet, there are 3D avatars in some papers (P2, P3, P13). In most of the cases, avatars show progression or improvement due to users' actions or tasks. In this scenario the avatar increases the perceived value [2].

Although the analyzed papers do not suggest that this element improves engagement or motivation, it has students' approval from their insertion on traditional games and social networks, and this insertion may create users' engagement with the environment [2].

Finally, teams and social graph refer to social contact. Social networks and social media are pervasive nowadays. The authors in P8 suggest that these possibilities lead to positive results in virtual learning environments. This is mainly because virtual social contact is very common among digital natives.

The elements of teams and social graph make users feel part of a community and their actions contribute to more rich learning environments. Some authors point out that these elements are indispensable to reach the pedagogical dimensions and guarantee the quality of virtual environments [22].

6 Conclusion

Gamification in learning scenarios has become an increasing focus of interest for educational researchers for the effect on motivation among digital natives. The assumption is that combining learning environments with game elements and mechanics can contribute to engage learners and thus achieve more success.

In this scenario, our paper has conducted a systematic literature review in which the research goal was to see how the specialized literature uses gamification elements in virtual learning environments.

To meet this objective (goal?), a systematic review was conducted through the stages of planning, conducting and reporting the review. In the planning stage, we defined the research question which pervades our work. In conducting the review, we selected the data source from specialized literature, collected studies that were able to answer the research question and extract the information needed. Finally, in the reporting the review stage we discuss the results obtained from this research.

When evaluating the use of gamification elements there were predominantly inclusions of badges, points and leaderboards (PBLs). These elements were frequent in gamification approaches although we found that not all insertions presented positive outcomes. These elements must not divert the learner attention from pedagogical objectives.

Badges and points are presented as prominent elements depending on intended use. Furthermore, we have found that the most controversial element was leaderboards, that may harm students' motivation when promotes explicit competition.

We have also found that beyond the traditional PBL elements, there are many others that, although less frequent, are also able to present good results in VLEs. Together, these elements may promote motivation, collaborative learning, knowledge sharing, engagement among others.

The challenge is to design such environments to gather elements that promote learning outcomes and creatively fit these elements in pedagogical projects.

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