The effect of badges on the engagement of students with special educational needs: A case study

Abstract This paper addresses the perceived benefits from gamification in the context of special education. It presents the findings of a study evaluating the effects of a specific gamification element (badges) on the engagement of five students with special learning needs, through online courses developed on the Moodle Learning Management System (LMS). The results indicate that this particular gamification element yielded positive effects on students' engagement and on their overall attitude towards the educational process in general.

1 Introduction

Gamification attracts increasing interest since it can improve user engagement and enhance the positive attitudes regarding the use of a service. According to Deterding (2011), gamification is *"the use of game design elements in a non-game context"*, while Hamari (2014) defined gamification further as *"a process of enhancing services with motivational affordances in order to invoke gameful experiences and further behavioural outcomes"*. For the purposes of this study we adopted the definition proposed by Dominguez (2013), where gamification is defined as *"the process of incorporating game elements into non-gaming software application to increase user experience and engagement"*.

Up to date gamification has been incorporated with commercial success into web applications (Zichermann & Cunningham, 2011), while education is an area with high prospects for the application of this concept (Kapp, 2012). It is quite common that mundane learning activities especially for long periods of time may not be appealing for students. This is one of the reasons that educators are often searching for innovative methods and approaches to make students more interested in participating in classroom activities (Kiryakova, 2014). The use of ICTs in the classroom can serve this purpose. According to OECD reports 2015, children's access and use computers earlier than ever before may lead to highly stimulating experiences, which may shape their expectations of education and learning. However, reality in our schools lags considerably behind the promise of technology. In 2012, 96% of 15-year-old students in OECD countries reported that they have a computer at home, but only 72% reported that they use a desktop, laptop or tablet computer at school and in some countries fewer than one in two students reported doing so (OECD, 2015). Furthermore, the widely used current E-learning systems have been primarily focused on course administration and facilitation, such as for teachers' communication with the students and students' submission of assignments. From a pedagogical point of view, one of the major limitations of the E-learning system, compared to the teacher, is they cannot convey emotions or fully engage the student (Muntean, 2011).

In recent years, there is an emerging line of published research with promising findings on the effect of gamification in real life e-learning settings. However, research in the area of special education is relatively limited, especially in Greece (Ern, 2014). Empirical studies

indicate that gamification has positive effects on user engagement and motivation (Hamari, 2014, Hamari and Koivisto 2013; Denny 2013; Morschheuser. 2014) and can hold promise for increasing the motivation of students in the learning process. However, empirical evidence reports mixed results (De-Marcos, 2014), and therefore further research is needed in order to investigate how and when gamification is most effective for whom? Within this context of inquiry, this study investigates gamification, with special focus on the effect of badges, in a group of students with special educational needs through an online course developed in Moodle.

2   Related research

Games are widely acknowledged for increasing users' motivation. According to the Federation of American Scientists, there are many elements that make a game motivating and understanding those elements can aid the application of gamification in education. In fact, many of the features used in high quality learning environments such as clear learning goals, opportunities for practice, monitoring of progress and adaptation to the level of the learners are also found in video games (Morris, 2013).

According to recent literature in gamification (Borges, 2014; Hamari, 2014; Garamkhand, 2014), the most popular gamification elements are the following: points, badges, leaderboards, levels and narration. In most empirical studies gamification has yielded positive results, but there is evidence that there are also some risks. According to Lee and Hammer (2011), gamification may teach students that they should learn only when provided with external rewards. Moreover, gamification seeks to increase motivation by providing extrinsic recognition and reward for completing activities, but there is also the possibility that such rewards can de-motivate learners with high intrinsic motivation (Glover, 2013).

Literature reviews carried out in this field report that gamification has gained increasing attention during the past few years (Caponetto, 2014; Hamari, 2014). These reviews have shed light on the emergence and consolidation of gamification in education/training and emphasized the rapid increase in the publication of academic writings during the past couple of years. In the review by Hamari (2014), education is found to be the most common setting for gamification. The results of their study depict that the effect of gamification is mostly positive; however increasing user's engagement depends on other factors. The role of the context being gamified and the qualities of the users are two of the most important aspects regarding the success of gamification (Hamari, 2014). Similar are the results in Surendeleg et al's (2014) review. They concluded that research regarding adult learning is very limited and suggest exploring further the impact of gamification on lifelong skills in adult learning. They also argued that gamification can enhance students' engagement and improve learning but since most studies are quantitative, it remains important to focus more on how, why and to what extent gamification enhances learning (Surendeleg, 2014).

The majority of theoretical papers regarding gamification focus on the reasons explaining the value of gamification for education, with reference to psychological theories regarding external and internal motivation (i.e., Deci's (2001) self-determination theory, Fogg's (2009) behavioural model for persuasive design). These theoretical models can be associated to theories of learning, making it possible for the authors to suggest effective models of using gamification in education to the extent that gamification is treated as "The gamification of learning and instruction" (Kapp, 2012).

With respect to empirical research, the largest portion has been conduced in higher education and there is very limited evidence regarding gamification in special education settings (Caponetto, 2014), which has instigated the selection of the research context for this study, that is, a resource room for students with special needs in a primary mainstream school. One of the first empirical studies (Gaasland, 2011) in this field was carried out with University students and used an isolated gamification element (points). The evidence, based on a student survey, indicated that the gamified e-Learning system was only somewhat motivating. Another quantitative study (Santos Ferreira & Lacerda Santos, 2015), which offered specific empirical evidence on users' engagement and task completion, was conducted with teachers. In this study, instead of isolating a gamification element, the original software was enhanced with different gamification strategies, in alignment to the individual characteristics of the users. Some studies have implemented both badges and leader-boards (Dominguez, 2013), while others combined a wide range of different game mechanisms (Li et al, 2012). In the application of gamification for training and learning purposes, it has been quite common to use points (Gaasland, 2011; Morschheuser et al, 2014), leader-boards (Hamari & Koivisto, 2013; Witt, 2011) and badges (Denny, 2013; De-Marcos, 2014).

Badges, in particular, are used extensively in our everyday life to denote social status or some kind of achievement. Similarly, in the gamification area badges are considered a game element utilized as part of the reward mechanism for when users reach a specified target (Zichermann & Cunningham, 2011). Therefore, badges represent achievement and interest and contain meta-data, which help to explain the context and the importance of the process as well as the outcome of a sequence of actions (Gibson, 2013).

Despite the positive and encouraging findings of experimental research on gamification, mostly conducted on custom platforms, there is limited empirical evidence on experiments conducted on gamified courses accommodated by Moodle, which is one of the most popular Learning Management Systems. In this context, the research aims to contribute to the empirical evidence by implementing an isolated gamification element to a Moodle course and evaluating its effect on students with special educational needs. The present study has addressed the following questions:

- Can a gamification element, namely badges, be an incentive to further engage students with special educational needs in the learning process?
- How badges affect students' performance in an educational resource room?
- What is the effect of an isolated gamification element, such as badges, on students' interest for a course?
- What is the view of a special education teacher about a gamified e-course?

3   Methodology

This research was conducted in the form of a case study, mainly due to the small number of participants and the students' different learning needs. In special education, this research design is quite common as a result of the difficulties in recruiting a sufficient number of children with similar learning needs (Mazurek & Winzer, 1994). The resource room is one of the most common settings of public inclusive education in Greece. This classroom is served from one special education teacher who teaches students with a wide range of learning difficulties (i.e., dyslexia, ADHD, mild intellectual disabilities). The students in this class are

withdrawn from the mainstream classroom depending on their needs for specialized one to one or group instruction.

Overall, this study involved five students, from 7 to 10 years old, with special educational needs. The students were divided into three separate groups according to their difficulties and individual learning goals. The first group consisted of two students who did not have spoken and written language compared to their chronological age, mainly due to their severe difficulties in phonological and phonemic awareness. The gamification intervention designed for those students was focused on those difficulties. The second group consisted of only one student with attention deficit disorder and learning problems in reading, writing and maths. The remaining two students (one with mild mental retardation, and the other with emotional difficulties) were grouped together because of their common difficulties in language and maths. For the first group, the gamified course included embedded badges and was conducted only in the language subject area, while for the two other groups we developed two gamified courses, including badges, one for the subject of language and another for the subject of maths. All courses had the same course structure: each course was broken into units and each unit included an introduction as well as two or three activities.

Figure 1 – Screenshot of the Moodle course used in the study

Each student would receive a badge as a reward for the successful completion of each activity and/or unit. In addition, a background audio-visual script was presented, accompanying students through the activities and the units until the completion of the course. Course activities were similar to those used by the special education teacher in the resource room on a daily basis prior the intervention. The goal of the intervention was to investigate how the isolated gamification element included in the Moodle courses would affect students' motivation and performance and therefore it was regarded of high importance that the only factor altered in the learning experience was the included gamification element and not the course's material itself. Since the purpose of this study was to determine the effect that badges would have on learning, the activities were designed to be as similar as possible to the

activities that students had already experienced, so as to exclude the possibility the activities themselves affecting the result.
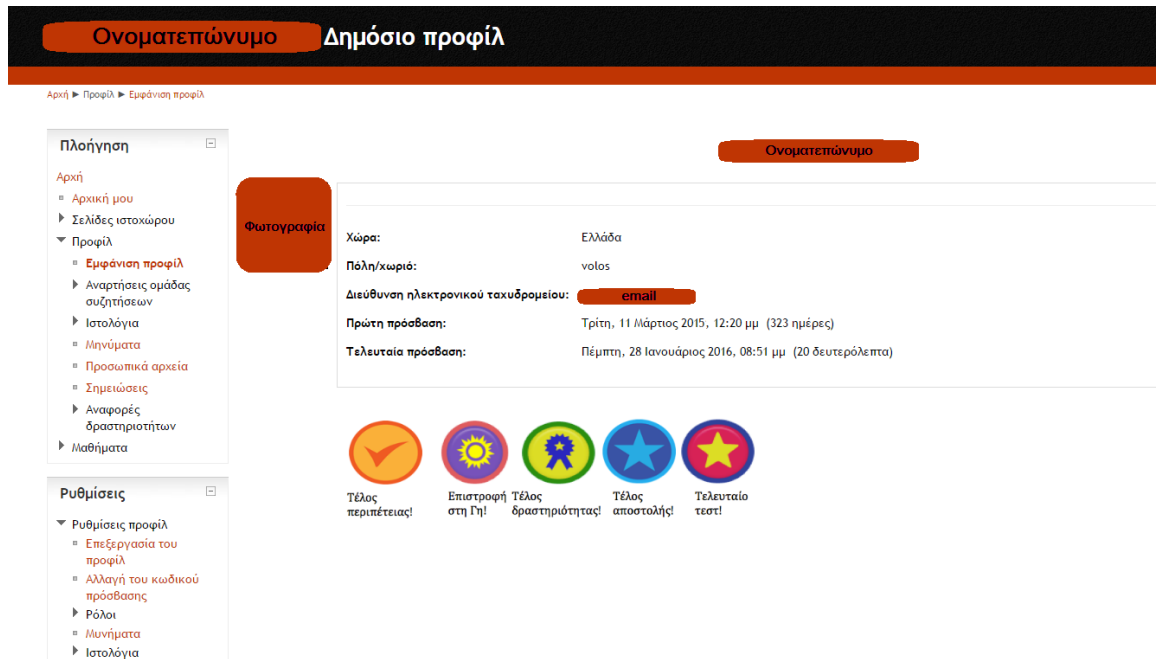
Figure 2 – Screenshot of the gamification components of the Moodle course

The activities developed for the gamified courses were varied in format. The courses incorporated presentations, gap filling and matching exercises, multiple-choice questions, short-response questions, as well as some tests. Upon the completion of each course, students were asked to complete a final assessment test with multiple-choice questions. The gamified online courses were developed in Moodle, which is among the most widely used platforms in e-learning. For the purposes of this research and once a week, the students instead of attending the course in the typical manner, they would join the school's lab to attend it through the gamified courses developed in Moodle. The experimental procedure lasted for five weeks.

For the purposes of this research the data was collected through the process of interviewing the five participating students, as well as from interviewing the special education instructor who was in charge of those students and attended the whole process. In addition to the information collected from the interview, quantitative data was also collected from Moodle's integrated statistical tools to evaluate further the individual performance of the students, by measuring the frequency rate, the duration and the recency rate of students' interaction with the gamified courses in Moodle.

4   Results

During the experimental procedure, a total of four interviews were carried out with the students. Each interview was transcribed in full verbatim and responses to each question were analysed. The main findings of the analysis are presented below:

Can a gamification element, namely badges, be an incentive to further engage students with special educational needs in the learning process?

Both the students' and the teacher's responses revealed that students perceived the gamified online course as more interesting and motivating compared to the conventional mode of course delivery. The use of narrative and the implementation of badges seemed to make the learning process more enjoyable and stimulating for the students. According to the teacher: *"All students enjoyed the fact that they were awarded a prize at the end of an activity and they would always stare at it every time the activity was completed. At the end of a unit and before leaving the lab they would double check if their reward was still there and therefore I think it was a strong reinforcement for the students, positive reinforcement. So I think they found it interesting in general"*. Moreover, the fact that at the end of each activity the students would also count how many badges they had collected so far, confirms that badges constituted an important incentive for them.

In agreement with research in the field of gamification in education, the results of this study were also positive. Nevertheless it is worth noting that, although in many studies it is quite common to find a number of students not enjoying the gamified learning experience, in this case all students perceived the gamified courses as interesting and thus their motivation was high. This finding may be explained with the young age of the sample of this particular study, in the sense that younger students are influenced more easily than students in higher grades. However, it is also important to note that the small number of participants does not allow for reaching any firm conclusion on the role of age in enhancing interest and motivation in gamified learning activities.

A very interesting finding is that in the case of the student with ADHD, the gamification element was incentive enough to make the student concentrate for much longer than usual. This finding could trigger further research to explore whether other isolated gamification elements or combinations of several of them could help students with attentional problems to concentrate for longer periods of time than usual.

Can badges affect students' performance in a resource room?

The results of the final evaluations were based on an assessment test, in which all students achieved high scores, showing their understanding of the content of the gamified e-courses. However, this does not suffice to assume that their performance had been positively affected. The findings from the interview with the teacher and the students supported that students experienced increased motivation and perceived the activities as different and more exciting, which in turn, may explain their enhanced understanding of the courses' content and high performance across all participants. These claims relate with students' comments in the interview: *"I feel I know now to read better"* and *"It helped me to write"*. As in other published surveys, the results on performance are not clear. In most cases, the results appear to be positive, but there is not enough statistical difference to safely confirm better performance. A longitudinal study would help obtaining more reliable results. Moreover, the inclusion of a control group attending conventional/traditional face to face teaching activities would enhance the strength of any future research investigation.

Is an isolated gamification element, such as badges, sufficient in order to make a course more interesting for the students?

One of the persisting questions in the literature is whether an isolated gamification element is sufficient to increase students' engagement. In this study, students with different special educational needs perceived badges as sufficient enough for evaluating a course as more interesting than a conventional face to face teaching activity. One of the main findings in this study is that the use of a reward (or positive reinforcement) created strong incentives for the students to participate more actively in the learning process. Both the students' and the teacher's responses indicated that as a result of receiving badges students felt more excited and enjoyed the course. All the students elaborated on their badges in their responses, which suggests that badges had attracted their attention. The instructor had also pointed out: *"The students would ask me to escort them to the lab" and "They enjoyed the courses since the beginning. The fact that there was a story and that they had to complete some activities in order to assist the protagonists of the story and that they would earn a prize for doing so"*. The finding that the students had a strong desire to return to the lab and resume the gamified e-course is aligned to the definition of engagement (Zichermann & Cunningham, 2011).

As mentioned before, it is important to take into account the young age of the students. These are children from 7 to 10 years old, which may respond to the use of such methods more effectively than older students. Students of this age are surrounded by toys or games, either in tangible or digital form, and it is easier for them to understand and respond to a game-like experience. Moreover, the process of earning tokens is similar to the positive reinforcement techniques utilized by teachers such as awarding stickers which have proven to be effective and students of that age are quite familiar with their use in schools. While the samples of similar studies consist mostly of students of higher educational levels that are able to distinguish a game-like experience from a game, in most studies an isolated gamification element or a combination of elements is sufficient to increase students' involvement with the learning experience.

How useful is a gamified e-course considered by a special education teacher?

The gamified e-course developed for the purposes of this research had a supporting character and it was an auxiliary learning experience to the traditional lesson. The students interacted with the e-learning system and completed the activities in the presence and with the participation of the special education teacher who was responsible for those students. Therefore, it had been considered important to determine whether the whole process was useful to the teacher or not. Based on the instructor's responses to the interview, it is noted that the general attitude of the instructor towards the gamified online course had been generally positive. However, the instructor remained cautious on whether a gamified e-course could be used independently or in combination with face to face instruction: *"The courses have been an important incentive for the students and they have been quite useful for the teacher. However, students need teacher's guidance. Interaction plays an important role; it is not enough to let a child work on the computer. They may be lost. The teacher is needed to guide them"*. The presence of the teacher is therefore considered necessary, since some students are in need of guidance while interacting with a gamified e-learning system. However, the teacher suggested that if a gamified e-course was used in the beginning of the school year, it would have made the transition of students with special learning needs from their mainstream classroom to the resource room much smoother, as it would have been an additional incentive for them.

5   Conclusions and future work

The qualitative results indicated that all students enjoyed the gamified e-courses and the courses also aroused the interest of the students since all of them expressed their preference to continue attending the lessons in that format. Moreover, students would like more lessons to be carried out respectively. Yet, for the majority of students, a single game element seemed adequate for making the course look like a game and therefore to be perceived as more pleasant. Therefore, both badges and the narrative influenced the learning experiences of participants.

Both the badges and the narration seem to have affected the attitude of the students towards the courses. The badges have been a powerful incentive for the students. All students would anticipate and count the badges they had received. On the other hand, it seems that the narrative had urged students to try harder and had an effect on their attitude since they were inclined to help the protagonists of the story. This fact prevented the students from giving up and led them to complete the activities more easily and quickly. A clear preference between the badges and the narrative was not lucid. Badges however were a distinct and measurable representation of students' performance and therefore their award was predictable. Furthermore, the utilization of computers seemed to assist students' performance and therefore it could not be clear whether the students' higher performance was due to the integrated game elements or the facilities that the computer offers. The only case clearly implying that performance was affected by the integrated game elements is the case of the student with attention deficit disorder. In this case the badge had been a strong incentive for the particular student since he was able to keep concentrated for much longer than he would typically do.

This work aims to form the basis for a number of similar experiments, which will investigate the use and effect of different gamification elements in special education – this is the main reason for the selection of Moodle as the underlying platform. Our future work aims to investigate and compare the effects of different gamification elements for different categories of students with special needs. Moreover, our future work aims to combine structural gamification to content gamification, as game thinking is a more critical gamification factor compared to gamification elements by themselves, and since the two types of gamification are not mutually exclusive, taken together, could have higher impact on students' engagement and learning.

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