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Exploring the impact of gamification on student engagement and involvement with e-learning systems

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ABSTRACT

In spite of the unprecedented popularity to use innovative gaming concepts within the educational context in order to promote active learning, engage people and solve motivational problems, there is an emerging body of research work arguing that gamification is not effective to increase neither the students engagement nor the learning outcomes. In this research paper, an empirical study is conducted to explore how gamification can firstly affect the student learning engagement and the interactivity level with e-learning technologies. Secondly, whether it can be considered as a driving thrust to support sustained learning. A question board is designed and implemented to enable students ask and answer questions related to their taught modules where academic staff can also contribute and validate the most correct answers. The acquisition of data is performed through a period of 10 months in order to investigate the gamification impact over time. The gamified platform was integrated with the online e-learning portal of a university where the adoption of e-learning is considered extremely poor. The obtained results have revealed that gamification can be considered as a valuable tool to entice users for the uptake of educational systems and increase their interactivity and engagement.

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e-Learning; gamification;
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1. Introduction

There is an emerging body of literature on the use of gaming to improve the student learning engagement and motivation (Bellotti, Kapralos, Lee, Moreno-Ger, & Berta, 2013; Buckley & Doyle, 2016; Landers, 2014; Novak, Johnson, Tenenbaum, & Shute, 2016). Video games are designed to provide an interactive environment for players to progress through different challenges and goals whilst they have fun and learn about game mechanics. Game designers can create an immersive playing experience for users by aligning game mechanics and dynamics in tandem with adding narratives and feedback systems in order for players to explore the different stages of the game with seamless progression. Although, the creation of games for serious purposes can be traced back to more than a millennium (Wolfe & Crookall, 1998), the use of gaming concepts for educational purposes dates back to second half of the twentieth century (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011; Wolfe & Crookall, 1998). Malone (1980) discussed the appealing aspects for computer games which are grouped into mainly three classes; challenge, fantasy and curiosity. They have discussed how such aspects can be translated into educational purposes in order to address the lack of student engagement and motivation.

The term *gamification* has been coined recently to refer to the process of integrating and using game design elements in a non-gaming context (Deterding et al., 2011). Most of the gamification studies are employed in educational contexts in order to promote active learning, engage people and solve motivational problems using game-based mechanics and game thinking (Kapp, 2012). The advocates of gamification have been strongly arguing that the use of game elements whether in classrooms or virtual e-learning environment would enhance the learning outcomes by increasing students' motivation and engagement (Landers, 2014). In fact, well-designed gamified systems can offer continual opportunities for learners to improve their knowledge with spontaneous feedback whilst academic tasks are inculcated throughout the playing experience. Although, a set of emerging studies have argued that gamification for distance learning may not be always beneficial (De-Marcos, Domínguez, Saenz-de Navarrete, & Pagés, 2014; Hamari, Koivisto, & Sarsa, 2014) due to the lack of eye-contact and direct contact with the instructor. The majority of studies are in alignment that gamification has merits in education including immediate feedback, competitiveness, self-regulated learning and team collaboration (Chin, Dukes, & Gamson, 2009; Hamari et al., 2014; Jagušt, Botički, & So, 2018; Koivisto & Hamari, 2014; Sousa-Vieira, López-Ardao, Fernández-Veiga, Rodríguez-Pérez, & López-García, 2017). Further, harnessing the mechanics and potency of videos games to promote creative thinking could lead to new innovative ways of dealing with real-world problems within the educational context. The process of gamifying educational systems is driven by the remarkable momentum and success of video games with a strong basis on different psychological theories and behavioral motivational models (De-Marcos et al., 2014).

Although it is intuitively taken for granted that games can serve as a strong motivating factor for students, there remains a paucity of research in which the effectiveness of gamified educational systems are directly investigated and compared to traditional methods with many recent studies stressing on the necessity of rigorous evidence for the impact of gamification on student learning motivation (Attali & Arieli-Attali, 2015; Deterding et al., 2011). In this research, an empirical study is conducted to explore how gamification can affect the student learning engagement and interactivity with e-learning technologies and whether it can potentially be considered as a driving factor for sustained and long-term learning. A gamified question board is designed and implemented to enable students ask and answer questions related to their taught modules where academic staff can validate the most correct answers. The platform is featured with a number of gaming elements including scores, stars and leader boards providing students with an area to compete with each other in order to earn more points via interacting with the platform. In order to assess the gamified platform and gain a deeper insight on the impact of the gaming elements on learning engagement and the user acceptance to e-learning technologies, various objective metrics are collected to quantify the behavioral and cognitive engagement in addition to the involvement and competitiveness aspects. The acquisition of data is performed through a period of 10 months in order to investigate the gamification impact over time. This is one of the few studies where participants used the gamified system on a voluntary basis. The game elements were integrated with the online e-learning portal of a university where the adoption of e-learning is considered extremely unsatisfactory.

This research paper is structured as follows. Related studies and existing approaches for using gamification in e-learning systems are reviewed in the next section. The theoretical description of the presented platform and approach for quantifying the learning engagement in a gamified environment are described in Sections 3. Section 4 is devoted to show the experimental results obtained for the evaluation process of the gamified platform. Finally, discussions and conclusions are drawn.

2. Related work

The potentials of integrating gaming elements in the educational context have drawn unprecedented interest from the academic and gaming communities to harness their merits in order to create more engaging and long-term learning experience. The engaging nature of games is believed to facilitate and improve involvement, motivation and interest in conducting pedagogical activities in

addition to increase the retention level of learned skills (Bredemeier & Greenblat, 1981; Greenfield, 1984). In fact, the education sector has been the main focus where gamification research is conducted (Hamari et al., 2014). Many research studies have theorized that gamification would assist to increase students' motivation to achieve clear goals and tasks within an encouraging and competitive learning environment (Landers & Callan, 2011; Reeves & Read, 2009). Though, there is an emerging body of research work arguing that gamification is not effective to increase neither the students engagement nor the learning outcomes whilst the reported positive results for the impact of gamification is due to the novelty effects since such impact appears to fade off gradually throughout time (Chin et al., 2009; Christy & Fox, 2014; Farzan et al., 2008). Although, the use of gaming elements is reported to be appealing, empirical and theoretical studies have produced inconsistent patterns of results concerning the learning outcomes and motivation (Tobias & Fletcher, 2011). Filsecker and Hickey (2014) have grouped research studies on gamification into three main classes: (1) Papers discussing that no motivation impact with positive learning outcomes, (2) research studies reporting motivational impact but no effect on the learning outcomes and (3) studies which show impact of gamification on both motivation and learning outcomes.

2.1. Impact on learning performance

For the effect of gamification on the learning performance, numerous earlier studies which have used incentives to motivate employees or students in tests have generally reported marginal impact on performance and retention of factual knowledge (Baumert & Demmrich, 2001; O'Neil, Abedi, Miyoshi, & Mastergeorge, 2005). In an experiment conducted by Braun, Kirsch, and Yamamoto (2011) on students during their final year of secondary school taking the National Assessment of Education Progress (NAEP) exam where monetary incentives are used as extrinsic rewards to explore the gamification impact. The study found weak impact for incentives compared to a control group. Attali and Arieli-Attali (2015) performed an empirical research study to explore the direct impact on academic assessment by gamified points awarded for correct and fast responses. The authors reported that no effect on the accuracy of the results meanwhile the speed of response has increased in the presence of gamification. Further, the authors pointed to the complexity nature of designing a gamified system with the expected beneficial effects meanwhile they stressed that providing immediate feedback on performance in gamified activities can be helpful for students in terms of learning outcomes and motivation (Attali & Arieli-Attali, 2015). Several other studies from the education arena have reached the same conclusion that students who have followed non-gamified exercises or courses tend to perform in a similar way to those administered to gamified activities. Chin et al. (2009) suggested that factual information can be taught using simulation games though not necessarily more efficient than other procedures. Overall, the majority of prior empirical studies employing control design and objective measures have suggested that the effect of game mechanics on academic scores is marginal. In contrast to earlier findings, Domínguez et al. (2013) designed and developed a gamification plugin as part of an e-learning management system to test the gamification influence on university students via measurements derived from qualitative and quantitative data. The results obtained from the experiment indicated that students who have been administered to the gamified system, have obtained better grades in practical assignments and in overall scores. Surprisingly, the same study have shown negative correlation between gamification and written assignments as students subjected to the gamified settings have performed poorly on written-oriented evaluation and participated less in class.

2.2. Impact on engagement

Research findings regarding the impact of gamification on students' behavioral engagement are generally positive with many empirical studies reporting that the use of gaming mechanics

including points, leaderboard and badges appear to have a considerable effect on increasing the learners engagement which can be quantified by the number of message posts, usage frequency and scores (Coetzee, Schreuder, & Tladinyane, 2014; Denny, 2013). From a theoretical point of view, Muntean (2011) made an analysis on gamification elements as a tool for increasing the engagement of using learning management systems. Using Fogg's behavioral model, the authors argued that gamified elements can be harnessed to motivate and trigger the desired behaviors for students. Hew, Huang, Chu, and Chiu (2016) carried out two separate experiments within an Asian university to investigate the impact of gamification on student behavioral and cognitive engagement. It was found that the integration of gamified elements has produced greater engagement with remarkable students contributions made on discussion forums. Further, students had expressed positive effect on attitude and motivation to perform more difficult and challenging activities on the gamified platform whilst the quality of the produced artifacts contributed by students subjected to the gamified experiment was higher than those for the control groups. In the work of Filsecker and Hickey (2014), the authors suggested that positive impact of gamification could be achieved by setting the rewards to have more informational value. However, Hew et al. (2016) reported that no impact on the acquisition of factual knowledge was observed from the deployment of gamification. In another study published by Li, Grossman, and Fitzmaurice (2012), the authors argued that students can find pedagogical course activities more enjoyable when subjected through gamified experience. In spite of mainstream research publications about the impact of gamification on motivation, Mekler, Brühlmann, Opwis, and Tuch (2013) stressed that the deployment of gamification elements including points and leaderboards does not have an impact on the student's intrinsic motivation. Thus, different studies suggested that gamification might or might not work, which shows that there is a lack of understanding about what makes gamification more effective in educational scenarios.

3. Materials and methods

3.1. Research questions

The findings of previous studies have provided educators and researchers with an understanding about the use of game mechanics in educational settings. However, the majority of research studies merely presented descriptive statistics and limited experimental results related to the impact of gamification on the acquisition of factual knowledge or students' engagement. This research study makes a number of contributions by investigating the impact of gamified elements for the academic community to uptake and to adopt the use of e-learning systems. The research study performed within a university where the use of e-learning is described as totally unsatisfactory. The other contribution brought up in this paper is to study the temporal aspect of the gamification impact on student engagement and explore whether gamification can contribute to the university community to continue using e-learning technologies. In brief, this empirical study is set to answer the following research questions:

- (1) Would gamification impact the engagement level of students with e-learning systems?
- (2) Is such effect of gamification due to the novelty effect related to introducing a new platform?
- (3) For how long such effect would last on the students engagement with the e-learning system?

3.2. Context and materials

The gamified e-learning system used in this research study is a question board which was implemented within the existing online e-learning portal for the University of Souk Ahras. The developed system can be accessed from the following URL: www.univ-soukahras.dz/en/

questions. The question board is made as a clone to the well-known website StackOverflow.com. The aim of the platform is to promote the use of blended e-learning where academic staff can give their lectures in class and afterwards students can post questions related to the given lecture or course. The University of Souk Ahras is located in the East of Algeria with over 12,000 enrolled students and 670 full-time lecturers. French and Arabic are the main two languages used at the university for teaching meanwhile English is used occasionally. The university website interface is made available in those three languages. For the implemented question board, the university users including students and staff can login to the platform to ask a question under a specific taught module. Students can post answers to existing questions meanwhile the lecturer of the module has the access rights to select a specific answer as the most correct answer. The users of the platform can vote up or down on all entries including questions or answers. Students would be shown by default only the questions posted within the course where they are enrolled unless they navigate to the global question board to see all questions made by all students at the university. The question board has a main menu to show the recent questions, questions posted by the user, unanswered questions, most answered questions and top scoring students. The aim of the platform is to encourage students to use online technology and learn new skills by interacting with each other under the moderation of their lecturers. A screen shot for the main page of the question board from the main university website is shown in [Figure 1](#) which shows the English version of the interface.

The platform is implemented using PHP and MySQL JQuery/Ajax are utilised to smooth the navigational process. The application was deployed under the guidance of the ICT center of the university to ensure the integration with the existing online infrastructure. An administrative system is provided for the ICT members to screen all activities and remove abusive or inappropriate messages or even ban users. In order to publicize and increase the awareness of the platform to the university community, a visible green button is placed on the sidebar of the main page of the website in addition to adding a direct link to the question board from the account menu links as shown in [Figure 1](#). To improve the involvement of students, a module for sending notification to students is implemented as when a lecturer posts a new question under their module, a customized email would be sent to all students enrolled to that module. In the same way when a student posts a new question, they would receive an email notification when a reply is posted to their question. When a lecturer sets an answer as the most correct reply, an email is sent to all users who have contributed to this particular question thread.

3.3. Gamification strategies

The platform is developed as part of the e-learning project within the University of Souk Ahras in order to encourage students use the online portal. Gamification is considered as a tool to entice and motivate students as well as academic staff to interact and adopt more online technological tools for the academic context. To gamify the question board platform, the most common gamified elements in the literature are implemented for students to compete with each other via asking questions and earn virtual rewards including points and stars. The integrated elements are described as follows:

- **Scores:** It is considered as the most important basic element in gamification serving as a virtual incentive given in return for conducting a particular task. Every student registered at the university e-learning portal is assigned an initial score of zero point. The score of the student is shown next to their name on the gaming leaderboard. For sensitiveness concerns, lecturers are not assigned a score nor a score is shown next to their names. Students earn more points by posting new questions or replies. [Table 1](#) shows the different activities leading to accumulate more points. Because by nature people would always look for shortcuts to earn points and hold a leading position, a number of restrictions are put in place to stop

The screenshot displays the 'Question Board Platform' interface. At the top, a navigation menu includes links for HOME, UNIVERSITY, RECTORATE, COURSES, RESEARCH, FACULTIES, LIFE ON CAMPUS, and LIBRARY. The main header identifies the 'Department of Mathematics and Computer Science' with the URL www.univ-soukahras.dz/en/dept/mi. Below the header, there are tabs for 'Recent Questions', 'My Questions', 'Unanswered Questions', 'Most Answered', and 'Top Students', along with an 'Ask Question' button. The 'ALL QUESTIONS' section lists several questions with their respective vote counts (up and down arrows), answer counts, titles, askers, dates, and star ratings. For example, the first question is 'what's the origin and meaning of the word et al. ?' with 2 votes and 3 answers. The right sidebar features a 'MY ACCOUNT' section with options like 'e-Learning : Cours, TD & TP', 'Centre for Exam Papers', 'Question Board', 'Affichage : Délibération, TD..', 'Modifier Mon Profil', 'Change my password', 'Bandwidth Usage', and 'Logout'. Below this is a green 'QUESTION BOARD' banner, followed by a 'TOP STUDENTS' list showing names and their point totals. At the bottom, a 'DEPARTMENT' section includes a link 'About the department'.

Figure 1. Question Board Platform from the University of Souk Ahras.

abusive and deceptive actions. For instance, a user is awarded only once per question thread regardless of the number of replies they make. Besides, a timing limit is imposed to disallow users from posting multiple questions within a short period of time which is set to 15 min per question per user. In the same way, voting is limited to one vote per entry per person whilst the user is limited to cast only one vote within 5 min. Restriction is further imposed on the number of characters for the written content within an entry to at least 10 characters.

- Stars: As opposed to using badges awarded after achieving specific levels or completing a challenging task (Alomar, Wanick, & Wills, 2016; Hamari, 2015), stars are awarded to users after earning a certain number of points elaborated using Equation (1) where p is the number of points and s is the number of stars awarded. For instance, one star is awarded for gaining 50 points, two stars are given when accumulating 100 points meanwhile five stars are given after reaching a score of 800 points. The awarded stars are always shown next to the name

Table 1. Activities on the gamified platform to earn points.

Activity description	Number of points
Posting a new question	5 points
Posting an answer	2 points
Own answer selected as best	15 points
Own question/answer voted up	1 point
own question/answer voted down	-1 point

of the student along with their scores. In the same way to scores, gamification elements are not applied to lecturers.

$$p = 50 \times 2^{5-1} \quad (1)$$

- **Leaderboards:** This is a special page to list the top scoring students with their awards such that visitors can view, compare and recognize their achievements. Considerable amount of studies on gamification have stressed that leaderboards have tremendous impact on motivating students to engage more with the gamified system for the sake to be listed in better positions compared to their classmates (Christy & Fox, 2014; Mekler et al., 2013). For the implemented question board, a leaderboard page is created for every course level meanwhile a global leaderboard is provided featuring all courses at the university. A sidebar leaderboard widget is added in a prominent place on the website showing only the top 10 students as shown in [Figure 1](#).

3.4. Participants

For the study, the question board platform is made available to the university community including students and academic staff who can use the system on a voluntary basis using their university account credentials. There are 863 students who used the platform to ask questions, post answers or cast votes from a total population of over 12,000 full-time registered students at the University of *Souk Ahras*. There are 284 male and 579 female student participants. The age distribution of the students enrolled at the university is ranging between 18 and 26 years. For the academic lecturers, there are only 36 lecturers from a total of 670 teaching staff who used the platform on a voluntary basis. For the type of teaching staff, 6% are university full professors whilst 16% are academic lecturers with a doctorate degree and research experience. Assistant lecturers are doctoral research students who can assist and teach at the university ([Table 2](#)).

3.5. Measures and metrics

In order to address the raised research questions on the impact of gamification on students engagement and the adoption of e-learning technologies by students and lecturers, we have considered a number of dimensions to quantify. Objective measurements are based on the interaction usage of users with the platform in addition to their achievement and artifacts. The interaction usage is captured using a snippet of code from Google Analytics which was appended to every browsed page to

Table 2. List of participants.

Variables	Categories	Number of users (%)
User type	Students	863 (96%)
	Lecturers	36 (4%)
Students' gender	Male	284 (33%)
	Female	579 (67%)
Staff gender	Male	29 (81%)
	Female	7 (19%)
Students' level	Bachelor	677 (78%)
	Master	186 (22%)
Staff academic rank	Professor	2 (6%)
	Lecturer	16 (44%)
	Assistant lecturer	18 (50%)
Students' discipline	Engineering & Technology	192 (22%)
	Biology & Veterinary Science	58 (7%)
	Management & Economy	25 (3%)
	Law & Political Sciences	211 (24%)
	Sport Sciences	33 (4%)
	Humanities & Social Sciences	117 (14%)
	Literature & Languages	227 (26%)

track all the events performed by the user anonymously. The following dimensions are considered to assess the impact of gamification:

- **Behavioral engagement:** Engagement is defined as *‘the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught’* (Zichermann & Cunningham, 2011). Gonida, Voulala, and Kiosseoglou (2009) referred to behavioral engagement as various energized or enervated behaviors and actions carried out by a person. This including for instance attention, persistence, giving up and passivity. For this research study, different metrics are considered to examine the behavioral engagement mostly related to the artifacts and interaction produced by university users. This includes the number of asked questions, posted answers and cast votes in addition to browsing statistics collected from Google Analytics such as the daily visit frequency.
- **Cognitive engagement:** Newmann, Lamborn, and Wehlage (1992) explained the engagement as the psychological investment and efforts devoted by the learner for understanding, learning or acquiring factual knowledge and skills. Measuring and assessing the cognitive engagement is proven as an intricate and challenging process. Hew et al. (2016) referred to the use of post test score and completion of difficult tasks in order to assess cognitive engagement for gamification. In this research, a number of metrics are deployed to quantify such engagement including the number of correct answers made by students in addition to the average accumulated score and awarded stars. Score progression can have an indication that students might have acquired or achieved some knowledge from their produced artifacts on the question board. This is because most of the earned points come from answers deemed as good quality by fellow students or academic lecturers.
- **Involvement:** Vivek, Beatty, and Morgan (2012) explained that customer’s involvement and participation are the primary requirements for engagement arguing that involvement is an affective, motivational or cognitive construct manifested as perceived personal relevance. Numerous previous studies stressed that both participation and involvement are key components for the success of gamification projects (Barata, Gama, Jorge, & Gonçalves, 2013). In fact, involvement can be measured as part of the behavioral engagement but it was assessed separately in this study to have better insight on how new users get involved to use the e-learning systems. The involvement is considered as the voluntary participation of lecturers and students to start using e-learning technology with the gamification elements. It is measured as the number of new active participants who have used the system either by asking new questions, posting replies in addition to passive participants who have contributed in stealth mode solely via voting activities.
- **Competitiveness:** This is to measure the degree of how much users compete with each other to score more than their peers and race to take leading positions. As yet there is no formal or mathematical formula to quantify the degree of competitiveness, a number of metrics are considered in this research to reflect the competition degree by students. The number of page views on the global leaderboard is considered as an insightful measure to indicate that competing students are always monitoring the progress of each other. An additional metric is taken into account as the number of ranking shifts or changes which happen within the top 100 positions of the global leaderboard. For instance, when the ranking of a particular student goes up or down, it is considered as a shift towards the final measure. Competition is also a sign that users are emotionally engaged with the application. Salen and Zimmerman (2004) have argued that games competition can lead to a sense of fun and pleasure which highlights high involvement of the players with the game.

4. Results

The gamified platform was launched for students and academic staff in May 2016 during the end of the academic year 2015/2016. The summer holidays started in July whilst the lecturers began

teaching in October for the new academic year 2016/2017. The exams for the first semester were set on 10 January 2017 just after the winter holidays taken during the last two weeks of December. The measurements and data which are based on discussed metrics are obtained directly from the SQL database of the platform [Table 3](#) summarizes the different metrics collected throughout a period of 10 months. We have chosen to extract data from segmented periods of two weeks. The denominator numbers shown in the table correspond to the overall accumulated number of entries or users. For the involvement aspect, the number of academic staff was poor during the early stage but progressed with an acceptable rate to include a total of 36 lecturers who have adopted the use of the platform as a way to interact with their students. The number of course modules where questions are asked reached 134 modules spanning over 46 courses. Meanwhile the number of total students on the platform reached 863 with 225(26%) regular active users and 638(74%) passive users whose participation is limited to voting only. There were three alumni master students who are observed to use the platform. In total, there were 138 questions and 607 answers made during the first month of launching the gamified application. The usage of the platform dived down to a low level during the summer period as students had already finished exams during the last week of May. Though, there were still a few students and staff interested in using the platform during the university closure. From the total 431 questions within the platform, there are 177 questions which were not answered by students. The total number of posted answers is 1010 with an estimated average number of 2.3 answers per question. For the students' achievement, there were five students who successfully gained three stars. The overall accumulated score for all students is 3708. From the total number of 431 asked questions, there were 46 (11%) questions with correct answers. For the competition degree of students, the global leader board have received surprisingly a total number of visits higher than most of the website university pages according to Google Analytics. For the language used for asking question, French is the most dominant language used by students with 57% of the questions. 29% and 14% of the questions are asked in French and English respectively. For the abusive cases, only one student was blocked permanently due to multiple misuse of the system and posting offensive messages.

To study how students interact and engage with the gamified platform, various measurements are shown in [Table 4](#) grouped by student level, discipline and gender. For the academic level, master

Table 3. Usage measurements of the gamified system over time (* Holiday period).

From Till	1 May 31 May	1 June* 30 June	1 July* 30 September	1 October 31 October	1 November 30 November	1 December 31 December	1 January 31 January	1 February 28 February	Sum
Involvement									
<i>New staff</i>	17	3	2	0	3	3	3	5	36
<i>New passive stud.</i>	52	4	5	10	26	115	372	164	748
<i>Particip. staff</i>	17	6	3	2	4	6	4	7	49
<i>Particip. students</i>	135	10	10	16	42	158	421	257	1049
Behavioral engag.									
<i>Questions by students</i>	138	2	9	7	8	38	64	49	315
<i>Answers by students</i>	607	2	1	10	16	48	68	224	976
<i>Entries by staff</i>	113	5	0	3	6	5	4	10	146
<i>Number of votes</i>	692	40	28	32	106	472	1,280	765	3415
Cognitive engag.									
<i>Accumulated scores</i>	1956	41	25	53	44	421	682	486	3708
<i>Awarded new stars</i>	13	1	0	0	1	2	4	3	24
<i>Select best answers</i>	27	2	0	1	2	3	6	5	46
Competitiveness									
<i>Ranking shifts</i>	235	17	8	13	20	196	364	288	1141
<i>Leaderboard views x1000</i>	1.4	0.2	0.5	0.4	0.5	1.4	2.9	1.3	8.6
<i>Platform views x1000</i>	39.2	5.4	11.9	12.1	13.8	29.9	83.9	71.5	267.7

students are observed to have more contributions on the platform compared to undergraduate students who prefer mostly to answer existing questions. For the bachelor level, first-year students are observed to interact more with the question board. In the same way, the average score for a master student which is 29.1 points, is considerably higher than the bachelor student estimated as 11.4 points. For the competitiveness nature among gender, there are 62 female students among the top 100 scoring users meanwhile their male counterpart scores more with an average score of 20.3 against 14.7 for female students. For students achieving being awarded three stars, there are two females and three males. In terms of contributions, the average numbers of published entries including questions or answers, 498 and 795 of posts are made by male and female students, respectively. For the area of study, students from the engineering faculty contributed more to the platform with a moderate number of 100 active students posting 128 questions and 697 answers with a high number of 19 accumulated stars compared to all other disciplines. More importantly, the lifespan of active students is computed to explore the impact duration of engagement of participants, it was found that the average lifespan for active students is 18.2 days meanwhile students from the faculty of engineering spend on almost a month interacting with the platform. In contrast to passive users who are reported to use the platform for an average lifespan of 4.3 days. The statistics for the participating staff in the gamified platform is shown in Table 5. Among the 36 staff who use the question board, there are only 8 who were using the e-learning system to upload their lectures and handouts for students. Female staff are reported to contribute less and have a low involvement rate compared to male lecturers meanwhile staff with higher academic rank are found to interact less with the gamified platform. Table 6 recapitulates the information on the contribution of all users on the gamified system based on gender.

5. Discussion

Within this research study, various contributions are discussed mainly related to the effect of introducing gamification in order to increase the engagement of students as well as to encourage the use of e-learning technologies. The aim of the project was to seek other ways to entice the university community to adopt the technological products for the academic context. As opposed to relying merely on self-reported data collected from questionnaires, the conducted study is based purely on objective measurements to reflect the veracity of the user acceptance to e-learning systems. This is because considerable body of research has stressed on the concern that subjective

Table 4. Usage statistics of students for the gamification platform : Engineering & Technology (ET), Biology & Veterinary (BV), Management & Economy (EC), Law & Political Sciences (LW), Sport Sciences (SP), Humanities & Social Sciences (SS), Literature & Languages (LL).

	Student level			Discipline							Gender	
	All	Master	Bach.	ET	BV	EC	LW	SP	SS	LL	Male	Fem.
Active students	225	65	160	100	16	7	14	3	62	23	71	154
Passive students	638	123	515	92	41	18	197	30	55	204	213	425
Questions	315	216	99	128	38	12	64	6	31	36	122	193
Answers	978	396	582	697	11	9	66	0	152	43	376	602
Students asking	101	55	46	40	10	7	10	3	11	20	40	61
Students ans.	169	39	130	87	8	3	8	0	55	8	47	122
Number of votes	3262	886	2376	971	140	60	715	111	373	892	1116	2146
Accumu. scores	3708	1892	1816	2171	159	56	529	98	330	365	1443	2265
Awarded stars	24	14	10	19	1	0	4	0	0	0	13	11
Average												
<i>Questions/active</i>	1.4	3.3	0.6	1.3	2.9	1.7	4.6	2.0	0.5	1.6	1.7	1.3
<i>Answers/active</i>	4.3	6.1	3.6	7.0	0.7	1.3	4.7	0	2.5	1.9	5.3	3.9
<i>Votes/all students</i>	3.8	4.7	3.5	5.1	2.5	2.4	3.4	3.4	3.2	3.9	3.9	3.7
<i>Scores/Active</i>	16.5	29.1	11.4	21.7	9.9	8.0	37.8	32.7	5.3	15.9	20.3	14.7
<i>Active lifespan days</i>	18.2	31.0	13.0	31.4	1.1	18.9	12.1	2.6	6.3	10.5	26.2	14.5
<i>Passive lifespan days</i>	4.3	4.6	4.3	8.4	4.2	1.5	3.2	1.8	0.9	5.4	4.2	4.5

Table 5. Usage statistics for the academic staff on the gamified platform.

	Staff academic rank			Gender	
	Professor	Lecturer	Assit. Lect.	Male	Female
Asked Questions	0	53	61	104	10
Posted Answers	2	18	12	28	4
Number of Votes	11	113	29	145	8

Table 6. Statistics for the contribution on the platform by gender.

	Students		Lecturers		All	
	Male	Female	Male	Female	Male	Female
Total	284	579	28	8	312	587
Participating users	33%	67%	78%	22%	35%	65%
Asked questions	39%	61%	91%	9%	53%	47%
Posted answers	38%	62%	88%	12%	40%	60%
Number of votes	34%	66%	95%	5%	37%	63%

measurements are less accurate and less expressive (Michalco, Simonsen, & Hornbæk, 2015; Pentland, 1989; Szajna, 1996). For the attractiveness and influence of integrating the gamification elements into the platform, the leaderboard is found to be one of the most important gamification components as achieved an extraordinary number of page views compared to other pages from the university main website. This reflects the considerable interest made by the gamified elements to allure the university community to visit and make use of the platform.

Based on the collected objective metrics in addition to the voluntary usage of the platform, the impact of gamification on the engagement of students with the e-learning gamified system is found considerably positive due to the large volume of published content and earned points. The findings are consistent with the results reported in previous studies (Coetzee et al., 2014; Denny, 2013; Filsecker & Hickey, 2014; Hew et al., 2016) which stressed that gamification has a positive impact on students' engagement. In fact, newly enrolled students at the university appear to be more motivated with a high degree of involvement and competitiveness. Most of the students gaining top scores on the platform are among the best students who have already achieved top grades. However, the effect on learning outcomes is not considered during this empirical investigation as assessing the true gain and acquisition of factual knowledge is beyond the scope of this study. For the case of academic staff, an indirect impact of gamification for the involvement aspect is reported based on students experiencing the platform. The use of students has attracted and influenced their lecturers to get involved and interact with their students by answering or asking questions. This is a milestone in convincing university lecturers to use e-learning technologies within a gamified environment.

Albeit the rich amount of studies on the benefits of gamification on motivating students for information systems, there is still a limited research on how such effect and impact would last. Previous studies have reported that the novelty of new technology would wither throughout time (Hanus & Fox, 2015; Koivisto & Hamari, 2014). We have found that there can be a surge of engaged users and contributions that might be explained to the novelty effect of deploying a new concept among the university community. But from the obtained numbers, results have revealed that there are always students who used the platform even during holidays or after graduation. At the individual level, estimating the lifespan of students to explore how many days they stay loyal to using the gamified system, 100 students from the engineering arena are found to spend a month on average using the platform which is considered totally satisfactory for universities and countries where the level for the adoption of e-learning is considered unsatisfactory. The impact duration can be further dependent on the design of the gamification system and nature of the platform. For the factors or variables related to the types of users, younger teaching staff have shown remarkable level

of engagement to use the gamified platform whilst older lecturers with high academic positions showed less interest. This is consistent with recent research studies which arrived to the same conclusions (Bringula, 2013; Wagner, Hassanein, & Head, 2014) emphasizing that the age as a factor, has an influential impact on the performance of users. In alignment to previous studies on gender (Mentes & Turan, 2012; Page, Robson, & Uncles, 2012) reporting that gender can influence the performance and utilization of technology, the obtained results obtained have indicated that female students have shown greater use for the gamification system in terms of involvement and contributions compared to their male colleagues. Inversely, male students are observed to be more competitive gaining more rewards (stars and points) as well as they have longer lifespan duration for the use of the platform.

6. Conclusion

In this research study, we have investigated how gamification can influence student learning engagement with e-learning technologies and whether it can potentially be considered as a driving factor for sustained and long-term learning. A gamified question board is designed and implemented to enable students ask and answer questions related to their taught modules where academic staff can validate the most correct answers. The platform is featured with a number of gaming elements including scores, stars and leaders board providing students with an area to compete with each other in order to earn more points via interacting with the platform. The acquisition of data is performed through a period of 10 months for users from the university community who have used the gamified system on a voluntary basis. The question board was integrated with the online e-learning portal of a university where the adoption of e-learning is considered extremely poor. For the impact of gamification on the engagement, motivation and uptake for using e-learning technologies, the empirical results have revealed considerable positive impact for students who have made large contribution on the platform in terms of published content and accumulated scores. Further, an indirect impact of gamification is observed based on the experience of students to influence lecturers to get involved and interact with their students and start using e-learning technologies. As such impact can be related to many factors including the novelty effect of using the gamified systems, the obtained results have revealed that there are always students who use the platform even during holidays or after graduation. Meanwhile at the individual level, estimating the lifespan of students to explore how many days they have stayed loyal to using the gamified system, 100 students from the engineering arena are found to spend a month on average using the platform which is considered totally satisfactory for universities and countries where the level for the adoption of e-learning is totally poor.

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