Gamification as an Educational Technology Tool in Engaging and Motivating Students; an Analyses Review

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The use of educational technology has been improving in schools since the turn of the century. The current educational curriculum has been revamped to incorporate information, communications and technology (ICT). The immersion has either been a stand-alone subject or infused into elements of other subjects, most prominently in Science, Technology, Engineering and Mathematics (STEM). In some educational technology research, it has shown that infusion of technology has shown contrasting results when it came to teaching and learning. Although, there have also been studies that shown improvement in motivation of the students in this technology laced classrooms, yet it did not lead to a better cognitive understanding. Furthermore with the problems such as difficulty in accessing to technology, teacher misconception about technology usage in classroom, we could not see the full extent of the educational technology capability. And so this spawns for the introduction of games as an educational tool; as it is related with enjoyment and is far off from its relation to work. With the infusion of technology, it has produced off shoots such as game based learning, serious games and more recently gamification. As gamification refers to the inclusion of ‘gamefulness’ to existing systems as opposed to creating an entirely new game; thus paves the way for easier implementation as an educational tool. Therefore this paper will discuss about the role of gamification as an educational technology tool in engaging and motivating students; based on analyses review of several literatures.

Keywords: Gamification, Education, Education Technology

1. INTRODUCTION

Gamification, a term that was started by Nick Pelling, a programmer back in the 90’s to bring in the game elements into non-gaming elements. Though his initial intention was to bring the fun aspects into transactions such as withdrawing money using the Automated Teller Machine (ATM) or in improving the in-flight entertainment system which he seemed to be dull and lacking the fun factor yet this idea did not catch up with the tech users. Consequently resulting in gamification being left in the wilderness until it caught the second wind through its gradual introduction into the World Wide Web (WWW) and via android and apple devices. Despite the term being credited to Pelling, the gist of the usage can be traced back to the early communist thought and transgressed to the soviet era; where it was used as a substitute for financial incentives to carry out any work.¹

With the re-emergence of gamification, Deterding et al.,² came up with a definition based on the original idea of Pelling, which is the “use of game design elements in non-game contexts”³. Gamification is used to change behavior, to educate, or to motivate using game elements such as points, badges and leaderboards. The technique of reward laced gamification already has a common ground in the social media and in applications (apps). The arrival of android and apple devices that has introduced a wider audience to this approach so, indirectly encourages the rise of new gamers. Recent advancements in education has seen the arrival of “digital natives”³,⁴,⁵ whose lives are always intertwined around technologies⁶. Young adults and teenagers fit easily into this category as they were born and raised in an age of computers and e-devices. As a result enabling their motivation into any technology based learning is getting more and more difficult as their daily routine may include hours mingling around with devices’ varying from computers, hand phone to game consoles. In addition, the existence of social networks such as Facebook and apps such as Whatsapp, the students has progressed into a collaborative environment that related to their motivational affordances⁷. Consequently students tend to feel held back by the boring chalk and talk lessons that happen in a conventional traditional classroom. This ultimately leads to the disengagement of students in the

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schools due to perceived boredom towards the environment.

So based on the developments above, the gamification is a process that needs to be carried out systematically and in orderly manner to ensure a successful injection into education. It cannot be assumed that results via gamification are an instant success. Gamification can create a state of flow in a person that enables or pushes one to be in the zone to carry out certain tasks. Meanwhile the aspects of mastery will exist if the users can get immersed in the gamified system hence is willing to repeat the tasks given, henceforth they are used to it or that they become an expert in the system; en route to achieving the goals intended. A person will continue carrying out the tasks until they have achieved the intended goal that allows the users to feel complete or satisfied. Thus gamification creates the extra push to achieve the motivational factors.

2. GAMIFICATION FOR ENGAGEMENT AND MOTIVATIONAL PURPOSES

A research by Spence et al., 8 on “gamified” library orientation tutorial was designed and introduced to the students in the Engineering Science program at the University of Toronto. The purpose of this gamified tutorial was to help students achieve the Information Literacy Standards for Science and Engineering/Technology, as well as introducing them with the methods of finding out the right resource for their studies. The idea of the “gamified” learning system was aimed “to create incentives for learning, to allow for self-paced learning, and to introduce students to the professional body of knowledge they will need as professional engineers” 8. In comparison to the previous method of “Introduction to Library Usage”, a short library introductory course where the students went through strenuous station based exercises that do not give the students ample of time to get used to the learning element that is wanted to be conveyed. Meanwhile, the gamified method for instance, promoted exploration allowing students to choose certain tasks of their liking. As opposed to monetary rewards, the students were given stamps or points that were needed to be collected and completed to proceed to the next task. This promoted self-directed learning among the students as they made their own decision to choose the path of activity that they prefer to progress. Overall student were found to be more motivated and engaged to the new method of learning to use the library resources.

Unger et al., 9, whose research looked into gamification and blended learning on employee productivity. Gamification elements such as virtual achievement badges and digital certificates were given out as a form of recognition and to infuse the element of fun and competition in learning. The researcher found that there was increased productivity through gamification and blended learning using an engaging training environment.

The training environment created was also taken up in other department of the company, so that they could create their very own gamified training environment.

A research by Thom et al., 10, whom removed “points”, a key game element related to gamification, from an Enterprise Social Network System (SNS) found that there was a clear negative impact on the user activity after the removal of points. This was more apparent when it came to reduction in contribution by the users. For that reason the researcher were determined that the discontinuation of game like mechanics will have motivational impact on the users, especially the new users. The researcher suggests that a new form of game mechanics need to be introduced if there is flatness of previous elements, hence ensuring continuous motivation.

Based on the findings above we can see that gamification is more than receiving points, badges, or acquisition of a higher reputation. Gamification implies the use of game mechanics to guide participant’s behavior toward autonomy, mastery, and purpose. These perceptions lead to an increased engagement, more competent enhancement, and advanced accomplishment. 11. This perception was further developed by Marczewski et al., 12 whom distinguished the motivation level into four categories:

1) Relatedness-“the users want to have social connection and feel belonged in a group”.
2) Autonomy- “the users want to be in control, and prefer freedom in choosing their path”.
3) Mastery-“the users that prefers personal development”.
4) Purpose- “the users want to know the reason why they are doing these tasks, altruism”.

Therefore it can be suggested that the elements of gamification have the potential to increase student’s motivation and engagement. However, it is crucial to identify their levels of motivation as introducing a reward system in an optimized environment has a potential to disrupt the flow; resulting in dependency on the rewards, and demotivation if the reward system is removed.

Finally the reward too needs to be achievable and desirable to push up the motivation level, yet it has to be limited to create a sense of achievement in receiving it; meaning in creating a sense of achievement, the students require more than receiving points. A different type of rewards needs to be granted to the students as they may feel bored or unappreciated from achieving the same complimentary badges as others. Hence there should be an exclusive reward allocated for the best of the best. Besides that, to make them feel more appreciated, peer compliment can be encouraged. Meanwhile as found by Thom et al., 10, point’s element in a gamified system can have negative impact if it’s withdrawn from an already existing system. This was highlighted by Zichermann et al., 13 whom stated that one cannot stop the external motivators if the users are used to it. This was more evident in new users into a certain system as they may only be getting immersed in the system, with the points
being early boost. Before they get to know the system, they are evidently demotivated by losing the extrinsic motivational factor, which are the point’s elements.

3. GAMIFICATION AS AN EDUCATIONAL TOOL

According to the research carried out by Epema & Josup in Netherlands, it was found that the quality of education has dropped significantly in science and mathematics. As a consequence the researcher concluded that using gamification can help in striking a balance between work and play. The researcher used the Richard Bartle’s player motivation types to identify and cater to the different student skill and personalities. For the gamification approach, the research looked into elements in the framework of game; mechanics, dynamics and aesthetics though for this research aesthetics was bypassed as it was less foreseeable thus not investigated. The results showed that the completion rate on the course’s increased as the students were satisfied with the course. Student’s satisfaction was identified through surveys, volunteered testimonials and in-class participation. Besides that it was found that class achievement improved due to the networking and competition aspect introduced to the students. There was also an improvement when it came to attendance and through the continuous analysis of the results, the researcher managed to identify winners and achievers player types which can help in catering for the needs in the teaching and learning process in the future. This has introduced a method of identifying individual users’ needs in extending their understanding, despite the research into the all the player types are not extensive and the relationship between achievement, intrinsic and extrinsic motivation has not been evaluated.

A research by Filsecker & Hickey, wanted to see whether the immersive educational game can help users from the negative consequences on their motivation and interest in solving ecological-related problems in the future. The research also intended to observe whether external rewards have positive effects on learning. The participants were from a public elementary school. The platform used was Quest Atlantis, as the game related to real life situation when it came to ecological problems. One of the scenarios used in the game was the Taiga scenario, which showed a park located along a river that is populated by loggers, tourists, farmers, fishing resort and a park administration. The task required them to come up with hypotheses and write a report to the park ranger regarding the reason behind the reduction of fishes. This invoked the student’s complex-socio scientific inquiry. The results showed that there were no significant differences for motivation level and engagement between control group and the gamified group. When it came to learning, those in the gamified users fared better than the control group. In aspects of external rewards, it was found that there was no significance when it came to its effect on the student’s motivation and interest. In terms of learning, there was a positive effect. The students also showed a deeper understanding of the concepts, topics and processes associated with solving scientific and socio-scientific problems in the performance assessment. Therefore when it came to external rewards in a technology enhanced environment has a positive effect on learning without having any negative consequences for motivation; as predicted by cognitive evaluation theory.

The research by Dominguez et al. looked into the contribution to the empirical evidence in the field by designing, implementing and evaluating a gamified experience in tertiary education. As per said by Lee & Hammer games can motivate due to its impact on the cognitive, emotional and social aspects of players thus should be incorporated in gamification of education. In the cognitive aspect of the gamified system, mastery learning is emphasized using the cycle of expertise so that the users have the necessary knowledge to proceed with further tasks. The emotional aspect is entangled around the aspects of failure and success in line with achieving the correct balance to achieve flow and finally the aspect of social revolves around creating collaboration among students. The course that was gamified was the “Qualification for users of ICT” and e-learning platform (Blackboard). There were two groups; the control group and the experimental group. Both groups went through the same types of activities. Students in the control group was given the choice in choosing between the gamified version and the non gamified version of the task, as per requested by the institutional requirements. The gamified version required them to register and upload their photos as avatars’ first before proceeding with the tasks. The results showed that the experimental group performed better in items related to practical application of concepts but lower when it came to written examination and participation. Therefore the researcher concluded that gamified activities helped to develop practical competencies despite hindering their understanding of underlying concepts. This showed that learning games help promote higher order thinking skills as compared to factual knowledge. The qualitative analysis concluded that cognitive impact was not significant for the gamified system as the traditional class user performed better in the exercises. Qualitative analysis meanwhile showed that gamification can have motivation and social impact on students. On the part of the participation, the researcher concluded that the gamified version fared less as compared to traditional class due perhaps to the alienation to technology factor or due to different teacher capability as these tasks were carried out in different organizations/institutions. On the aspects of motivation, the traditional classroom fared better, as this may be due to the fact that the rewards were not suitable, and perhaps the non-existence of immediate feedback and some stating that they do not prefer a visible leaderboard and competition among students as gamification could not be simply infused into a system.
As stated by Barata et al., their research carried out an empirical study to look into the prospects of engaging engineering students with gamification. The researchers came up with a two year plan to look into the effects of gamifying course taught in their Department, where a normal course was carried out during the first year and followed by the gamified version of the course using “Moodle”. The findings showed that the student’s engagement improved significantly, through course attendance and via the number of posts made by the students. Yet the researcher noted that there was no improvement when it came to the grades of the students. There was a notion of meaningless gamification seen in this course as some challenges were bypassed because the students thought those challenges were no use to them; for instance awarding the most attentive student that found typos in the lecture. The students also felt the need for achievement stages, in which some achievement can be unlocked only after the previous task, was completed. The users felt the need of Avatar that can create an online identity for them. And finally the need to have group tasks to create an opportunity for cooperation among students.

4. A MEANINGFUL GAMIFICATION

A meaningful gamification will only succeed if it puts the needs of the users first over the needs of an organization. When this occurs, users will have a positive experience which results in a longer-term and deeper engagement among participants, non-game tasks, and organizations. Focusing only on the game mechanisms will create a false scenario in achieving a goal. The positivity of the game based experience lies in the fun of play and not the points itself. When considering whether gamification can benefit a group of students, it is crucial to identify their levels of motivation and whether introducing a reward system in an optimized environment is feasible as the rewards elements have a potential to disrupt their flow and resulting in dependency on the rewards, and demotivation if the reward system is taken abolished. When planning a learning activity, gamification should be done and planned at the same stage because gamification cannot do much with low quality or poorly planned material and activities. Gamification should more use of quality based examples; such as students giving ratings and feedback among themselves; rather than just quantitative elements such as rewards and points. Finally the reward too needs to be achievable and desirable to boost the motivation level, yet it has to be limited to create a sense of achievement in receiving it.

5. DISCUSSION

Based on the articles above, we can see that gamification can influence in many aspects of education, whilst acting on as an educational technology tool. Despite the bad perception of games by certain researchers who feel game can have a bad impact on students, yet by taking in only game elements and infusing a pedagogical approach, we can harvest good elements via this approach. The table 1 summarizes the articles that have been discussed.

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<th>Article</th>
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<td>[8]</td>
<td>Gamified tasks and activities</td>
<td>Higher engagement &amp; motivation</td>
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<td>[9]</td>
<td>I.C.T tools</td>
<td>Improved engagement</td>
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<td>[10]</td>
<td>Social network system (SNS)</td>
<td>Demotivation due to the loss of game elements</td>
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<td>[14]</td>
<td>Gamified courses</td>
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<td>[16]</td>
<td>“Quest Atlantis”</td>
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<td>[18]</td>
<td>“Blackboard”</td>
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<td>[25]</td>
<td>“Moodle”</td>
<td>Engagement improved</td>
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The research by Spence et al., proved that gamification can also be used offline via activities and tasks. Errands of searching information in library were made interesting by using game elements such as rewards and points. Meanwhile, despite the gamified system being only used as a training workshop for utilizing IT and office communication tools, the added incentive of virtual badges and the freedom to learn at their own pace made the system so successful that the system was asked to be introduced in other departments of the company. A reverse engineering method used by Thom et al., showed that intrinsic motivation is affected when game elements are abolished. As supported by Glover who states that rewards has the potential to disrupt the flow of the users. This contradicts the findings by Filsceker & Hickey that found that according to Cognitive Evaluation Theory; external rewards can have positive effects on learning.

Based on the research by Epema & Iosup we can see that using Bartle’s Player motivation types can help in identifying the type of users of the system. This can be relevant in helping nurture certain types of users in progressing through the tasks given in the system. For example “achievers” player types need to go through a progress that requires them to achieve more points to go up the leaderboard, while “explorer” may prefer a more probing environment that requires them to find what want to keep the engaged to the system. This creates a learning environment that is suited for the students capabilities, as a result it will create an aura of fun and an enthralling game based experience as stated by Csikszentmihalyi, & Csikzentmihalyi.

Meanwhile the research by Filsceker & Hickey also looked into whether immersive educational games
can influence students in learning about ecological studies. With these studies being a part of the science field, especially socio-science, we can then relate it with learning science process skills in the subject of science. This is more relevant in the aspects seen as nurturing scientific inquiry skills. Furthermore existence of rewards helped in improving learning among students as stated by Glover.26

The research by Dominguez et al., 18 looked into the impact of cognitive, social and emotional aspects. The results showed that gamified group did better in application and concept element, which according to Ke 22 relates to higher order thinking skills. There was also a clear difference when it came to cognitive elements of the gamified system as the control group or the traditional classroom did better in the assessment; even though the level of participation and motivation was higher in the gamified environment. Though we can assume that the gamified system did not achieve a meaningful gamification24, yet this may be due to internal factor such as teacher’s capability or external factor due to the facilities used by the students. For instance, the lacks of instructional capability in educational technology may create a gulf in knowledge transfer between teacher and students. Besides that, problem in technology may occur as a result of internet connectivity problem or a faulty device that may push the students out of the flow zone, resulting in decreased participation in the gamified course.

6. CONCLUSION

Through the discussions above, we can conclude that gamification can be utilized as an educational tool successfully, nevertheless several impediments may occur. For example, if the need of the users is bypassed over the needs of the organization in its implementation or the use of game elements doesn’t take into account the needs of the users as a result leading towards a meaningless gamification design. As gamification only tackles the game elements and does not indulge deeper as seen in serious games or game based learning; hence it can be put to good use in teaching and learning as its implementation can be done both online and offline. This opens up the Pandora box of STEM learning that will allow the incorporation of gamification, in offline activities such as in Science and Engineering laboratories and online activities such as technology based learning. Therefore by equipping the teachers with the necessary knowledge about gamification; there will not be much problem in absorbing gamification as educational technology tool in engaging and motivating students.

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