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Learning Analytics on Student Engagement through Gamification in Massive Open Online Course

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ABSTRACT

Education system nowadays has moved forward in digitalization. The evolution of the education system brings learning institutions that offer online knowledge delivery as an alternative also in addition to giving more flexibility to learners gaining knowledge. This will benefit learners as they can set up their own environment when attending a class. However, the online environment means that learners and teachers are not interacting directly anymore. This led to low engagement between learner and teacher. Engagements between learner and teacher or the course itself are important as engagement will increase learner motivation in attending a class or completing a course. Gamification can be implemented to increase student engagement in online learning. To understand how far gamification contributes to increasing learner engagement and how it affects learner performance, this research is conducted. First, this research will study the engagement of learner in different parameters. The study mainly focuses on the trend of engagement on the respective parameter. For instance, the trend of learners engaging in the course by sharing their opinion in the comment section and how much did the learner spend their time on the course. The findings were used to identify the type of gamification that engage student more towards the course. The study about the enrolments trends was also done for this research.

1. Introduction

Education system has been improving year by year. Distance education and traditional classroom has now been revolutionized by Information and Communication Technologies. The improvement in education technology has provided students with more control over their learning pace via self-paced and self-regulated learning activities [1]. Due to the growing number of institutions offering courses, faculty members must stay current on the evolution of online learning environments, including course structure, learner engagement, and teacher interaction. Massive Open Online Course (MOOC) one of the results from the education revolution. Even though online learning provides self-paced learning, learner and instructor interaction is still an important key in teaching and learning process.

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Engagement can help students increase their focus as well as to enhance their interest in a particular subject. However, it has been shown that students are more likely to lose their concentration on a certain topic as time passes. Student attention and lecturer performance decline from start to the end of a traditional one-hour lecture. In Figure 1, it shows student performance with and without break if the lecturer gives a break whether in form of playful activities or rest would lead to student performance.

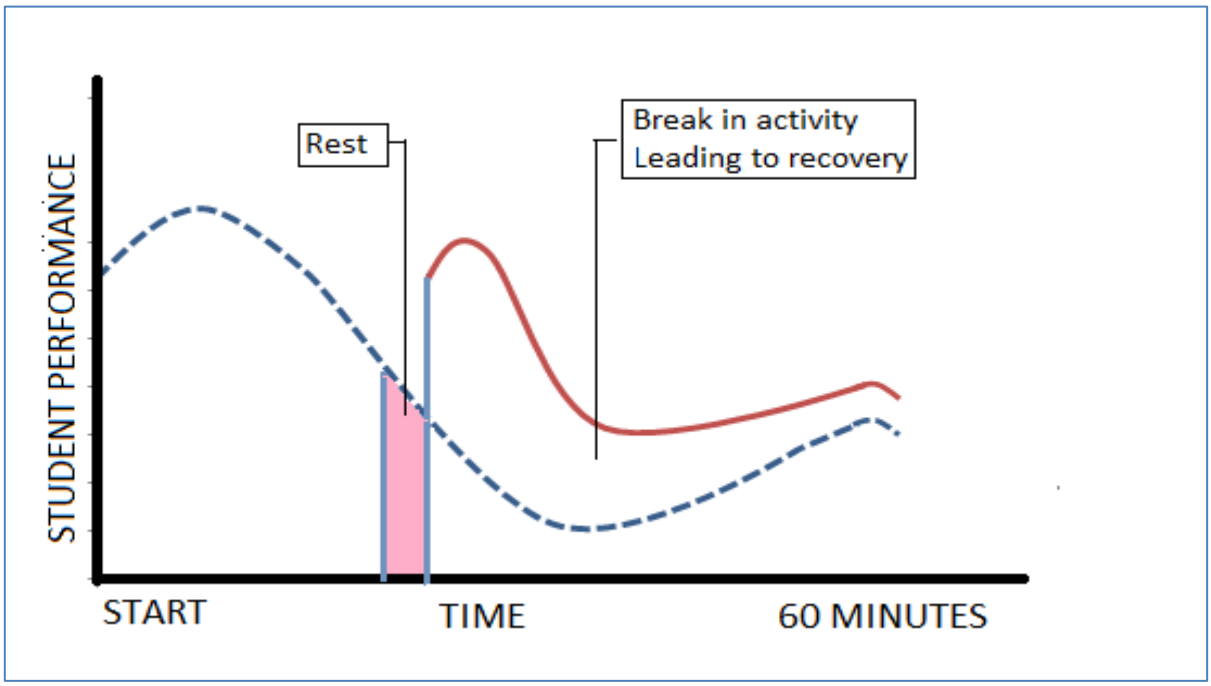

Fig. 1. Student performance level in a classroom (Y-axis performance, X-axis- time) [2]

Gamification implementation is one of the methods to get student engagement during online class [3]. Gamifications refers to a software or application that uses the elements of games. The most common element inside gamification is leaderboards, points, and badges. The main aim of gamification is to increase users' motivation which will lead to a better experience and engagement among users [4]. Gamification is where game concepts are applied in education to allow learners learning while having fun [5].

1.1 Problem Background

This current era provides tons of websites in which anyone can choose to gain knowledge such as MOOC. With MOOC getting new knowledge sure at the tip of our finger. Unfortunately, MOOC has 91 to 93 percent of dropout rate [6]. In short, from thousands of students enrolled for a course in MOOC, only 70 to 90 students manage to complete the course. A 2014 study [7] on 508 students in different online learning platforms found that 15.35 percent of students claimed that one of the reasons why they have withdrawn from a specific course is due to the course offered is not engaging enough for them.

1.2 Research Objectives

Based on the issues stated, this research is conducted with the following research objectives:

a. To identify type of gamification element that is suitable for MOOC.
b. To identify students' engagement from different type of gamification element through log data from MOOC.
c. To study the enrolment trends in MOOC between 2016 to June 2021.

2. Literature Review

2.1 Student Engagement

In the education context, engagement can be described as a measure of students' participation toward the learning process. This context includes the cooperation and interaction by learners with their fellow classmates and teachers [8]. This section will define 3 key factors related to engagement that is behavioral, cognitive, and emotional engagement in contexts of MOOCs. Cognitive engagement is commonly described as mental preparation to understand complicated idea and to expert involute skills [9] while emotional engagement involved reactions to problems, ways of expressing their thoughts and sense of belonging, as well as fun and liking when attending a class or course [10]. Qualitative research mainly used to study student emotional engagement.

Student's behavior on the other hand involves an engagement that can be observe and measure quantitatively. For example, the amount of completed assignments, online quizzes participation, and involvement in forum discussion. A study in 2017 [11] discovered that consistency and perseverance in learning activities are associated with learner engagement and achievement. This indicates that when learners are participating highly with most of the class activities, their learning abilities will be improved which is also linked with their success in the course [12].

2.2 Massive Open Online Course (MOOC)

The MOOC contains various courses offered with a large number of participants. By the end of the year 2020, there is about 180 million students registered in MOOCs with over 16, 300 courses offered [13]. That was about 50 percent of increases in the number of participants compared to 120 million participants in the year 2019 [14]. The escalation in number of participants show that MOOC nowadays has become more relevant as a medium of getting knowledge.

Even though MOOCs are getting more popular, there is no guarantee that the completion rate of students in a certain course offered in MOOC is higher or lower. Gaining student engagement will be difficult with the online learning environment compared to traditional and blended learning. Many ideas have been presented by various researchers around the world to increase student engagement. With several studies, each of them provides a different solution to present disengagement in MOOC.

2.3 Gamification

Research in improving learning and teaching process has come to a result of new ideas by creating new learning practice that enhance student engagement through interaction, games, and experience design [15]. Games in a learning process is not a new thing. Generally, a game is an activity that one engages for amusement or fun. In traditional learning, games like role plays and sports were introduced which improves student participation in class and motivates students to come to class.

Applying games in education builds the excitement in learning [5]. Learners will have fun in the learning process, and this will improve learners' motivation and participate in the course [16].

In online learning, gamification often used to boost up student engagement. Some of the element in gamification are rules of play, competition with others and scoring points into other areas. The integration of game mechanics with current elements, prompts involvement thereby enhancing engagement and loyalty. Since the main objective is to soar student understanding, motivation and engagement, gamification creates a fun learning environment thus improving student performance [17].

2.4 Learning Analytics (LA)

The Learning Management System (LMS) stores student data when they are participating in e-learning course. This data can be used to study student's behavior. LA will then be used to improve student learning performance. It is the collection, measurement, reporting, and analysis of data on learners and their environments to better understand and enhance the learning process and environment. The main idea in LA comes from a large amount of data known as "Big Data". The data includes all the activities carried out during the learning process by all the elements or subjects enrolled in online learning and maintained in their database. Even though the data is usually straightforward to retrieve, the quantity of data to be analyzed is simply too large to be analyzed using a standard database tool. Besides, the materials needed to transform the data are often [18], which requires it to develop tools that can do filtering to the data to ensure meaningful information is extracted from them [19]. LA analytics in gamification provides a lot of data to be analyzed to understand student behaviors and learning environment in online classes.

3. Methodology

This research implements the Five Step of Learning Analytics model by Campbell and Oblinger [20].

3.1 Research Data

The data for this research involves 463 learners who enrolled in Web Programming course in MOOC-UTM between the year 2016 to June 2021. All the data collected is raw data which will be validated and cleaned after verifying which data will be used for this research. After data validation, the total number of data has been reduced from 463 to 307. This data is basically the overview of learner data in the course. The next data is the learner completion status for each topic inside the course. This includes online quizzes and project progress.

3.2 Tools

This research is using statistical analysis tool which is Microsoft Power BI. Statistical testing variables such as time spend on course, completion progress, comment and kudos were used to measure success for enrolled students.

3.3 Performance Measurement

Performance measurement of student engagement with gamification in Web Programming MOOC Course are based on LA results. Student level engagement in a different way was compared

with their performance. Correlations were used to identify the trends for students based on their engagement level. The engagement level can be measured by observing how much times they spend on the course, the number of comments and kudos as well as their frequency hit the web page. All these variables will be used to study the effect of gamification towards students' engagement and their performance.

4. Findings and Discussion

4.1 Gamification Elements For The Course

As discussed in section 2.3, there were several elements that can be consider as type of gamification implemented in online course. Even there was numbers of gamification elements implemented, only some are measurable or leave a significant result to student engagement. Below is the list of the gamification implemented.

4.2 Avatar

Avatar can be considered as virtual representative of a person in the virtual world or in MOOC, it is the profile picture. Research in 2019 [21] stated that, avatar help student to boost up their motivation and emotion while surfing the course. Unfortunately, in this course only few students have set up their avatar and there is no quantitative method to validate the relationship between avatar and their engagement.

4.3 Badges

Badges is a motivation booster for students to achieve a certain goal or task [22]. In this course, badges can be gain when student complete a certain module or receiving numbers of likes for their comment or their posted work. That is mean there more progress they make, the more badges they should get.

4.4 Comment

Commenting is one of the social engagements that can be observe and measure. When students leave their comment behind, that mean they are involve interacting with other students in the course. The level of engagement can be measure by getting the total number of comments by the students.

4.5 Kudos

Kudos is awarded to student when they have enough number of likes for their comment or other student are liking their work that is posted. Kudos is the perfect parameter to see the student level of engagement.

4.6 Leader Boards

Leader board implemented in the course is for student who enrolled in the course between early January 2017 until early March 2017. The leader board was released weekly to show who has the

highest completion rate for the course. This not only can motivate students in leader board list, but also those who are not in the list to climb up the leader board.

4.7 Progress Bar

Progress bars show students they are in how many percent in completing the course. The progress bar is reflecting on their progress towards the course. With the progress bar, students can have a visual view of their current progress.

4.8 Enrolment Trends

The enrolments trend will be discussed by the number of enrolments each year and the trends of enrolment by month. As depicted in Figure 2, the year 2018 recorded the highest number of enrolments with 25.49 percent from the total number of enrolments. With small differences 2017 recorded 77 number of enrolments. This situation brings to 25.16 percent from the overall enrolment which is the second highest number of enrolments. The year 2020 and 2021 have 61 (19.93 percent) and 45 (14.71 percent) of enrolments, respectively. While 34 or 11.11 percent of enrolments was recorded during the year 2019. The lowest number of enrolments was recorded in the year 2016 with 3.59 percent or 11 number of enrolments.

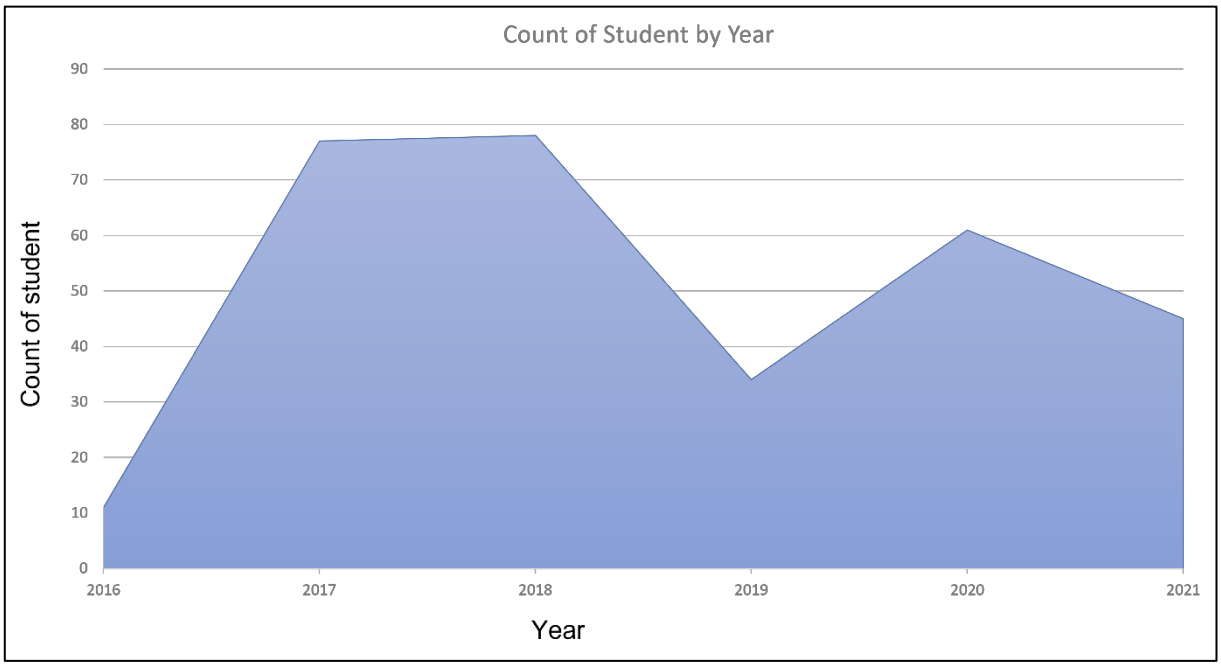

Fig. 2. Number of enrolments per year

Furthermore, the details number of Enrolments by Month as shown in Figure 3, between the 3 months in Quarter 2 which are April, May, and June; the highest enrolment was recorded in May with 41 number of enrolments. The highest significant drop in the number of enrolments was recorded in June (36) to July (16) with 55.56 percent decrease. While the highest increment of enrolments was recorded in July (16) to August (30) with a total of 87.50 percent of increases. December recorded the lowest number of enrolments throughout the year.

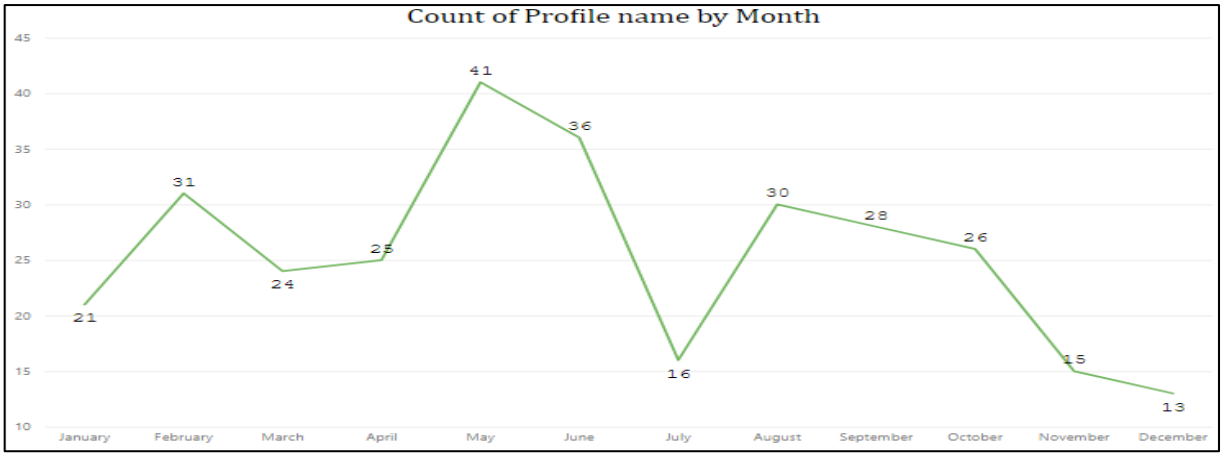

Fig. 3. Number of enrolments per month

4.9 Comments and Kudos

The first parameter was studied is total comment posted and total kudos gain. In total, 159 and 189 number of comments posted, and kudos gain was recorded, respectively. As shown in Figure 4, the highest comment posted, and kudos gain was in the year 2017. The year 2017 alone contributed to 88.36 percent (167) of kudos gain and 40.88 percent (45) comments posted from the total number of comments and kudos gain. Further studies have been done to analyse the reasons that bring a higher percentage of kudos gain for the specific year. The analysis is focused on the year 2017 by visualizing at which month's comment was posted and event or activities for the specific months.

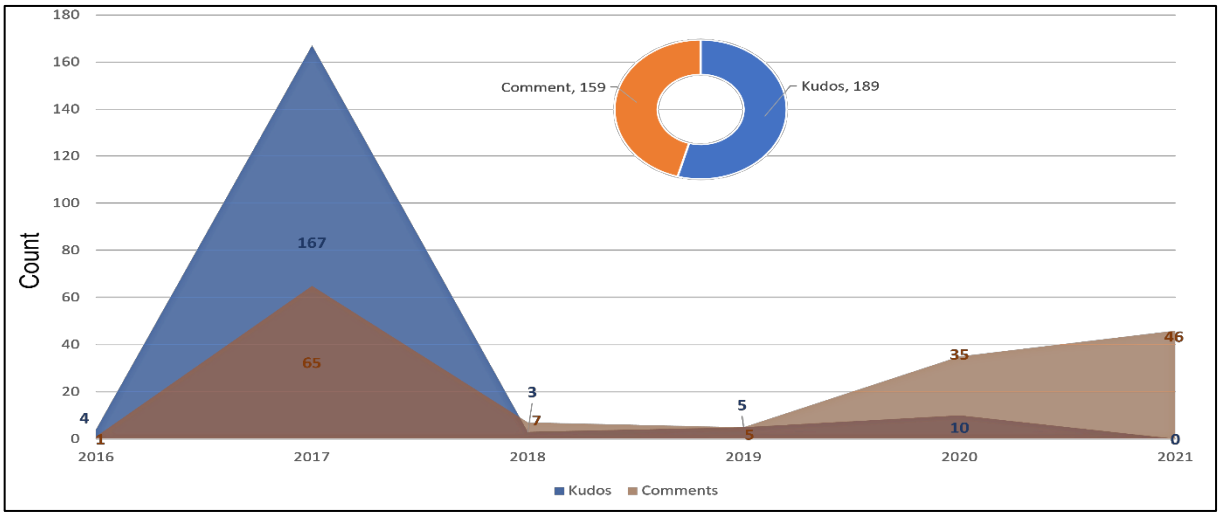

Fig. 4. Total comments and kudos

Figure 5 shows the total comments posted, and kudos gained in 2017. The result shows that in April, the highest number of comments and kudos was recorded. During this period, leader board (Figure 6) was published weekly to display top 10 learners who have the highest completion rate. The leader board was only available in April until May 2017. Only students who was active during that month was eligible to be listed in the leader board. This indicates that the learner is highly motivated to complete the course at that time. As the result, higher engagement was recorded during this period.

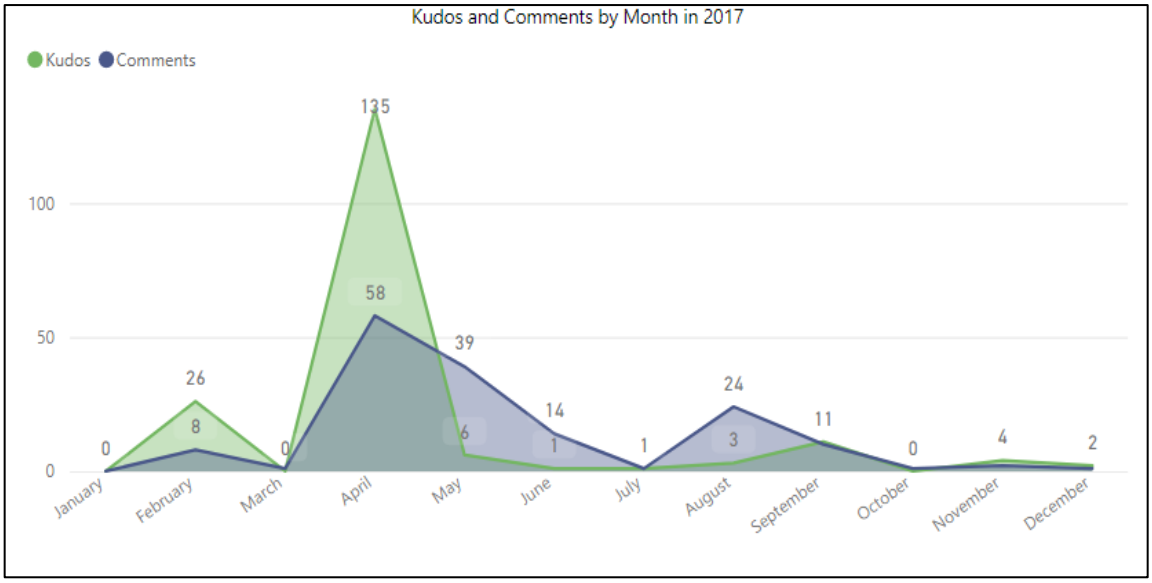

Fig. 5. Total comment posted, and Kudos gained in 2017

Fig. 6. Leader board design for the course in 2017 (Web Programming Course MOOC-UTM)

The relationship between comments posted and kudos gain was also done in this section (Figure 7). Scatter plot was used to visualize the relationship. Correlation coefficient then calculated. It was found that there was a strong positive correlation between the number of comments and kudos gain (0.64). Meanwhile, the chances of learners gain more kudos is dependent on their number of comments posted.

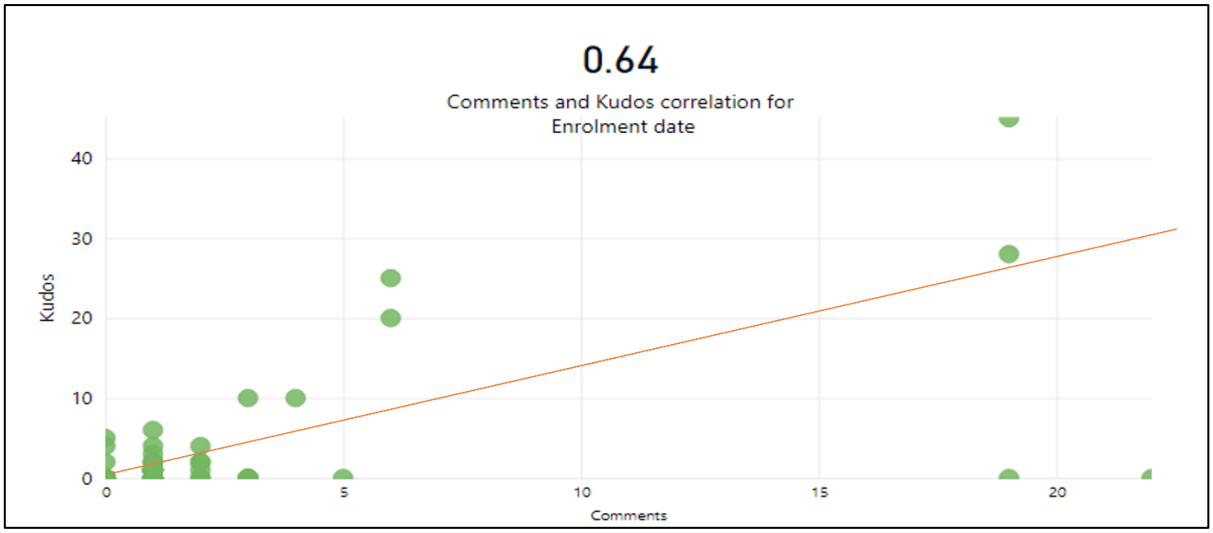

Fig. 7. Correlation between kudos gain, and total comment posted

4.10 Average time spends on course

The next parameter studied is the total time spent on the course. The result gained from the total time spent on the course is as shown in Figure 8. The main indicator to the total time spent on course is the total number of learners who enrolled for that year. If comparing Figures 8 and 2, the graph trend is almost identical that mean it is a common trend to have higher number of total times spend when the total number of enrolments is high. However, the Figure 9 shows the average time spent for each learner gives a different result. Even though the year 2020 numbers of enrolments (61) almost the same as in the year 2017 (77) and 2018 (78), the average time spent on course shows a significant difference where 2020 (1.07) recorded much lower average time spent compared to the year 2017 (6.26) and 2018 (5.48).

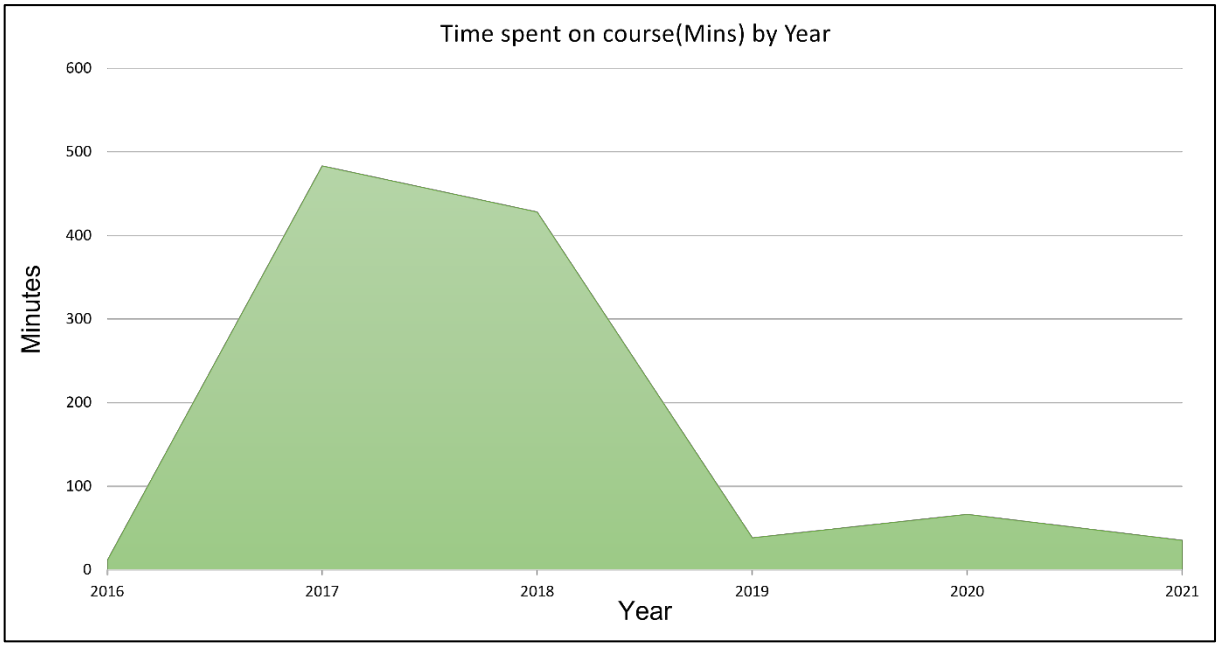

Fig. 8. Total time spend on course (minute) by year

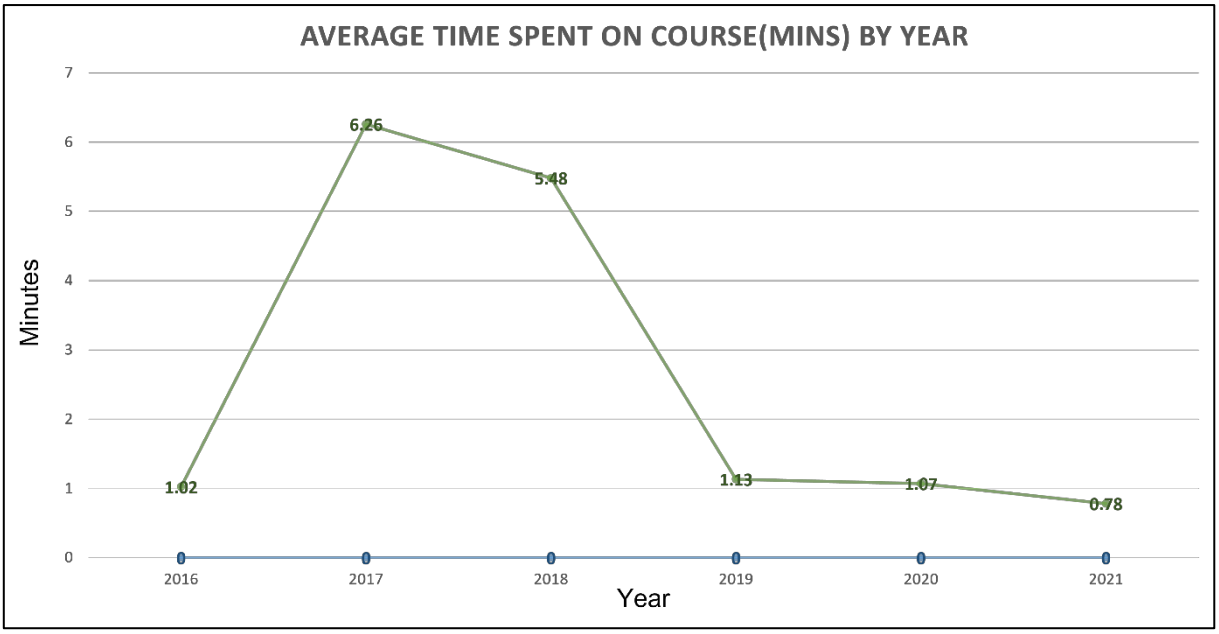

Fig. 9. Average time spend on course by year

5. Conclusion

In a nutshell, this research shows a significant relationship between gamification and student engagement. Based on the research done, there was several gamification elements implemented in the Web Programming course yet not all of it leave a visible impact on student engagement. For example, other researcher stated that avatar can increase student motivation towards the course, but only a few students set up their account with an avatar.

Apart from that, out of the several gamification elements, leader board leaves the most impact on engaging student to engage more to the course. Since the leader board was only available from April to May 2017, students take this opportunity to improve their completion rate. This encourages students to spend more time on the course. The longer they spend time on the web site course, the higher the probability that they will contribute their idea in commenting or event read other student thought regarding the course.

Next is the enrolment trends. Based on the result, there is no absolute pattern for the enrolment trend. In other words, students are expected to join the course in any month of the year with no guarantee on which month will have the highest enrolment.

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