The Effectiveness of using QUIZIZZ Application in Teaching in a Large Engineering Undergraduate Class*

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Student learning achievement is derived from many configurations between teachers, learners and class environments. Class size is one of the factors that usually consider for the learning ability successive. QUIZIZZ gamified learning teaching is rarely use in engineering calculation subject. Student learning behaviors become an issue that teacher must be suitable adapt. Due to their behaviors gradually change according to the technology and social network interruptions. A diversity of students from large class together with less engagement disrupting from freedom accessible devices are obstacle student learning ability. The GPA class in the past three years rather low between 0.8–1.4. Therefore, the author aims to rise student learning achievement by using appropriate application technology. This is the concept to activate and encourage them to maintain on lesson but still keep using benefit from electronic devices. According to those issues, this study proposes the gamified learning teaching QUIZIZZ application to contribute in this large class which is free accessible that convenient for both teacher and learners. Comparison using QUIZIZZ as active learning with traditional passive learning state that there is significantly improve their academic efficiency by increasing of average mean. Students assess that very high value that QUIZIZZ help to easier understand the lessons and help to improve their summative score. More than 80 percent of the students agree with no further improvement aspects especially they realize that the contents are well planned and prepared, and the learning objectives are clear. Also there is interesting result of student engagement, the 80 percent of student state that QUIZIZZ encourage them to fully participate accordance with the evident from number of student who maintain to study for entire semester. Moreover, the amount of students who success in excellent is increased while students who fail is decreased in significantly level.

Keywords: game base learning; QUIZIZZ application; large engineering class; active learning

1. Introduction

Teaching in a large classroom is a real challenge for almost lecturers. Due to there are several provocative can be disturb student's study. A diversity of students, lack of flexibility, class climate management, difficulty of setting and enforcing classroom behavior (crowd control), minimum attention to students, limited monitoring of students' learning and difficulty in engaging students to activities are mentioned as possibility occurred [1]. There is study that concern about the number of students defined for the large class which his case defined for 50 students [2]. Engineering Statics is the primary subject for undergraduate in the engineering field that are comprised in Institute of Engineering, Suranaree University Thailand according to Thai Qualification Framework (TQF) [3]. The learning method is centralizing system subject learning which all majors are mixed to take the basic subject

including Engineering Statics. Then this subject has operated between 3–8 sections which provide maximum 300 seats depending on semester. According to the Accreditation Board for Engineering and Technology (ABET) framework [4] accreditation of engineering programs that meet the criteria for preparing to become an engineer [5], students should have ability after learning this subject which is enabled to identify, formulate, and solve complex engineering problems, by applying principles of engineering, science, and mathematics. Students must learn this subject and qualify themselves following by Engineering license. Since the subject contents has their difficulty itself together with the large class environments which are easily lose interaction between teachers and learners. The GPA class of each semester is between 1.5–2.0 during three years passed.

Moreover, many of social medias such as Facebook, Instagram, TikTok, Twitter and etc. can be interrupted student learning concentrations. Social media users often time experience poor performance

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academically [6]. Similarly, [7] conclude that social media is negatively associated with academic performance of student and is a lot more momentous than its advantages. It is noticeable to say that the use of the social media during the lecture time is not recommended from most of respondents [8]. Especially the class of undergraduate that students are freely to manage their own behaviors. There was a negative attitude towards social media when college students used them. The analysis also indicates that an approach is needed to better balance the relationship between social media and academic study [9].

Unfortunately, that student behaviors have change in recently decade. They spend time much more with electronic devices such as smart phone, tablets and laptops during class time. Undergraduates spend more time on Facebook, Twitter and other social media through smartphones that are now in abundance among these youths [10]. Comparing with the traditional learning method which student bring only the stationary things and using paper based. The losing of concentration in learning perception and interaction between teacher and learner become a continuous issue. Activities of active learning is evidently helping the students increase learning performance in engineering [11–15]. Therefore, the authors aim to seek for the suitable solutions to rise student engagement that investigate by their learning achievement.

Chaiyo [16] shows the Kahoot and QUIZIZZ application could be help the nursing students to improve the perception of concentration, engagement, enjoyment, perceived learning, and motivation in the classroom. However, some study also show the Kahoot has little or no improvement on the learning performance. Derya [17] use the Kahoot and QUIZIZZ application for gamified learning experience for the education students. The QUIZIZZ also very popular for gamification learning and assessment [18–20]. Pitoyo [21] use the gamification learning using QUIZIZZ with 14 English students. The results show that QUIZIZZ can reduce the test anxiety of the students and suggest using the QUIZIZZ in the exam. Saleh [22] use the QUIZIZZ application to teach the mathematic subject for secondary school students. The results show that the QUIZIZZ can increase the interest in mathematic learning for secondary school students. Pitoyo [23] investigate the effect of the assessment by the QUIZIZZ application to the TOEFL course students. The results shown that students were motivated to learning deeply after adding gamified test with QUIZIZZ application. Handoko [24] also use the QUIZIZZ application for 29 students of project management information systems subjects. The results of this study show that the student can increase the e level of student

answers questions correctly. Zhao [25] investigated the effectiveness of QUIZIZZ on student learning experiences. The results show that this application can help the instructor to improve the teaching quality. Wang [26] shows some study can have a positive effect on learning performance for the accounting classroom. The QUIZIZZ application also a popular application to teach for English and language learning classroom [27–30].

There is no report on engineering calculation field using gamified learning as QUIZIZZ especially for the large classroom. Due to this finding this paper focus on investigation on QUIZIZZ gamified learning affect to the engineering calculation subject. The advantages of QUIZIZZ application is free accessible online application that convenient for both teachers. and learner. It can design for comprehensive question under answer time limitation which can well manage. It also can immediately provide the correct answer for feedback reviewing that students can track on. Activating them by comprehensive questions via QUIZIZZ application is the efficient method. There is strongly correlation between QUIZIZZ score and learning outcome scores. All previous studies compare between the pre-test and post-test relatively with the same question. However, this study considers the relationship between formative assessment and summative assessment.

2. Research Methodology

This section is comprised by overview of study framework which will explain the related analysis series. Next, the research equipment is explain including number of the questions and sets. Then, number of population is described. Finally, the theory of statistics test is described (Fig. 1).

2.1 Question Design

The questions are comprehensive design following as much as the core of the study contents. The alternative four choices are designed in total for 10 lessons, each lesson has 8–10 questions according to the content intensive. The question designed according to the program learning outcome of ABET to ensure that student should have ability after learning this subject which is enabled to identify, formulate, and solve complex engineering problems, by applying principles of engineering, science, and mathematics. Therefore, the question in each lesson conclude with the relevant basic principles, equation equilibrium formulations and solving answer. The questions were revised by several senior university instructors and teaching assistances, who, specializing in this subject. Free body diagram is the importance basic to start for engineering static problem solving. Then, the sui-
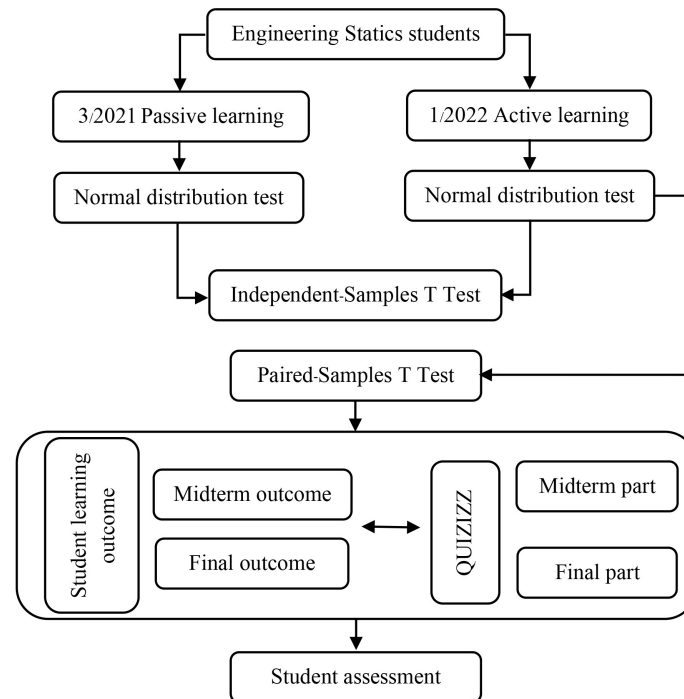
Fig. 1. Research Framework.

table theory and formulating mathematical equation must be tested. Finally, the correctly solving and calculation also included in the QUIZIZZ test. There are the examples of questions in QUIZIZZ listed in Fig. 2.
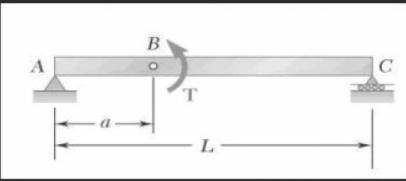
2.2 Sample

SUT use the centralize system which student learn the basic subject with the same curriculum at the first year and some of second year. Also these basic subjects are provided by the center education system which belong to institute of engineering. This Engineering statics subject is taking the responsibility by School of Civil Engineering for those all students belong in the others engineering fields. Therefore, this can be ensured that all students meet with the equally criteria even though they belong in different engineering fields. Engineering statics students are the population and observed for their learning achievement. The section that the author responds consist of 258 and 105 students of semester 3/2020 and 1/2021 respectively. Those students are variety mixed from the field of Agricultural and Food Engineering, Ceramic Engineering, Chemical Engineering, Computer Engineering, Electrical Engineering, Environmental Engineering, Geological Engineering, Manufacturing Automation and Robotics Engineering, Metallurgical Engineering, Polymer Engineering, Petroleum Engineering and Geotechnology, and Telecommunication Engineering.

2.3 Course Planning

The research is evaluated under the SUT learning system which operate by tri-semester system, each semester contains 12 weeks of class including the examination period. Engineering statics is the subject that is designed for four credit which separate for two days a week and two hours per day. QUIZIZZ is used at the beginning of the second date in the week, the first date is used for the feedback and reviewing on the previous class. QUIZIZZ is a kind of reviewing section which need student participation that can be assess for learning ability. The teaching planning for the first date is designed 20 minutes of reviewing and feedback on the last result from QUIZIZZ, then providing them for lecturing. Another second date is planned 5 minute for short reviewing and 15 minutes for testing on QUIZIZZ, then continuing on teaching. Using QUIZIZZ at the beginning has benefit that students starting with fresh and more activate. At about minute of 60–70 is the breaking period and giving them have the last 10 minutes for questions and preparing for the next class. The class planning schedule during two hours per day within a week is shown in Table 1.

2.4 Statistic Test

The statistical data were analyzed and summarized, in order to success for statistic test results and conclusions. The data in this study were coded and processed into SPSS which is a well-known
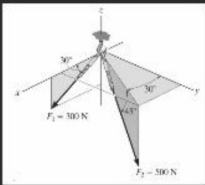
a. The basic principle questions.
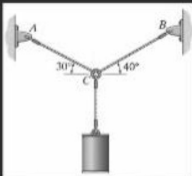
b. The equation equilibrium formulations.

c. The solving answer calculations.

Fig. 2. The examples of questions in QUIZIZZ.

Table 1. The class planning schedule

Class period (minute)	0–20	21–60	61–70	71–110	111–120
First date	Reviewing and feedback	Lecturing	Breaking	Lecturing	Question and answer
Second date	short reviewing and QUIZIZZ	Lecturing	Breaking	Lecturing	Question and answer

statistical package system. The data were explored both for their descriptive statistics (i.e. calculation of percentage distributions, frequency distributions, calculations of averages, and coefficient of variation) and inferential statistics (i.e. level of significance, t-test, z-test, ANOVA, correlation and regression and classification analysis). The population distribution was test at the beginning to check whether they distribute as normal by seeing of Skewness and Kurtosis value. A distribution, or data set, is symmetric if it looks the same to the left and right of the center point. According to Kline [31], the Kurtosis score < 8.0 and Skewness < 3.0 indicates that the data is usually distributed. Next, Paired-samples t-test that use for comparison of the two variables means for a single homogeneous group is analyzed with 95% confidence interval. Then, Independent sample t-test is evaluated to see the teaching method efficiency comparison between using QUIZIZZ application and not using.

2.5 Paired-Samples t-test

A paired t-test is used when we are interested to compares the means of two variables for a single group. The principle is to computes the differences between values of the two variables for each case and tests whether the average differs from 0. Observations for each pair should be made under the homogenous circumstantial. The mean differences should be normally distributed and variances of each variable can be equal or unequal. The assumption of statistics test is performed below:

Null Hypothesis: $H_0 : \mu_d = 0$: The average difference in score is 0 between QUIZIZZ and Midterm.

Alternative Hypothesis: $H_1 : \mu + d \neq 0$: The average difference in score is NOT 0 between QUIZIZZ and Midterm.

Point Estimate: $\bar{d}$ (the sample mean difference) is the point estimate of μ_d.

Test statistic: $t = \frac{\bar{d} - \mu_d}{s_d \sqrt{n}}$.

Note that the standard error of s_d is $\frac{s_d}{\sqrt{n}}$ where s_d is the standard deviation of the differences.

According to the t-distribution table using degrees of freedom and the pre-selected level of significance, α, if the absolute value of the calculated t-statistic is larger than the critical value of t, we reject the null hypothesis. Confidence Intervals of 95% can calculate around the difference in means. The general form for a confidence interval around a difference in means is:

$$\bar{d} \pm t_{(n-1, two-sided\ \alpha)}(s_d/\sqrt{n}) \qquad (1)$$

For a two-sided 95% confidence interval, use the table of the t-distribution (found at the end of the section) to select the appropriate critical value of t for the two-sided $\alpha = 0.05$.

Independent t-test

The Independent-Samples t-test procedure tests the significance of the difference between two sample means. This also displayed the descriptive statistics for each test variable, a test of standard deviation equality and a confidence interval for the difference between the two variables (95% or a value you specify).

3. Data Analysis Results

3.1 Normal Distribution Test

The distribution of all population is investigated to confirm for normal distribution by using Skewness and Kurtosis statistic as shown in Table 2. The distribution pattern need to know for correctly using statistic method test. The results show that all of population distribute as normally (Kurtosis score < 8.0 and Skewness < 3.0, [13]). Therefore, Paired-samples t-test and Independent t-test can be used for inferential statistics.

3.2 Paired-Samples t-test

The Paired-samples t-test is tested to confirm that QUIZIZZ score has similar trend with summative midterm and final examination score. This can be the evidence benefit to guild students make their decision on withdraw their course after knowing the score. There are two paired between QUIZIZZ and examination score of midterm part and final part as shown in Table 3. The population is 105 students which are assigned score as 40 and 50 for midterm and final part respectively. The null hypothesis is to

Table 2. The distribution testing using Skewness and Kurtosis statistic

Descriptive Statistics							
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic
QUIZIZZ (Midterm)	105	9.6	40	27.6171	6.83858	–0.603	–0.219
QUIZIZZ (Final)	105	0	43.75	27.1607	8.34531	–0.598	0.984
Midterm	105	0	38	26.1115	5.94674	–1.129	3.024
Final	105	8	44	25.8859	8.95618	–0.176	–0.731

Table 3. The Paired-samples t-test between QUIZIZZ and examination score

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Midterm	26.1115	105	5.94674	0.58034
	QUIZIZZ (Midterm)	27.6171	105	6.83858	0.66738
Pair 2	Final	25.8859	105	8.95618	0.87403
	QUIZIZZ (Final)	27.1607	105	8.34531	0.81442
Paired Samples Correlations					
		N	Correlation	Sig.	
Pair 1	Midterm & QUIZIZZ (Midterm)	105	0.269	0.005	
Pair 2	Final & QUIZIZZ (Final)	105	0.133	0.175	

Paired Samples Test								
		Mean	Std. Deviation	95% Confidence Interval of the Difference		t	df	Sig.
				Lower	Upper			
Pair 1	Midterm vs QUIZIZZ (Midterm)	−1.50562	7.75978	−3.00733	−0.00391	−1.988	104	0.05
Pair 2	Final vs QUIZIZZ (Final)	−1.27481	11.39903	−3.4808	0.93118	−1.146	104	0.25

identify an average difference in score equal to 0. All pairs demonstrate that there is better score in QUIZIZZ both midterm and final. This may cause from students has no restriction to discuss with their friends. Their QUIZIZZ score is finally transfer only 10% in total outcome. Therefore, this has less impact on student's evaluation but expect to has more student's engagement. The difference in average score between QUIZIZZ and Midterm of two pair is midterm 1.51, final 1.27. However, the statistic test shows that there is no difference in average score between QUIZIZZ and Midterm at 95% confidence interval. There is the different consideration of standard deviation as 7.76 and 11.40 between midterm and final pairs. Students who cannot response well has increasing in the final examination, the gap between well response and un well response is wider. The possibility reason is generally that the contents become more advances. This result can explain that students who can success during hard study in QUIZIZZ can also achieve in examination.

3.3 Independent t-test

There are strongly good results tested between two independent population of student studied in semester 1/2022 and 3/2021 as shown in Table 4. Once that the null hypothesis is to identify an average difference in score equal to 0. The statistic test shows that there is no significant accepting on the null hypothesis or it means that alternative hypothesis is accepted. The average mean between using QUIZIZZ Application and Non-QUIZIZZ Application is significantly difference of 17.881. Moreover, the standard deviation between two group is similarly at 14.12 and 13.47. This implies that the learning ability in each group is quite same, however some students in QUIZIZZ Application group can improve the average mean from 34.116 to 51.997. This conclude that using QUIZIZZ Application has an efficiency to apply in this subject.

3.4 Student Assessment

Not only learning outcome of formative and summative assessment are analyzed but also the student perspectives are assessed. Student impression is one of the achievement key to operate the large class teaching. There are three sections of questions asking for the QUIZIZZ usefulness in their perspective, student participation, and further improvement aspect. Students gave most top three percentage of 5 and 4 scores that QUIZIZZ help to easier understand the lesson, help to improve midterm score and make to reach the program learning outcome as shown in Fig. 3. Students assess quite well score of the QUIZIZZ usefulness, the proportion to assess at 5 and 4 score is rather high and the average is between 3.64 to 4.34 in Fig. 4. The highest average score is QUIZIZZ help students to easier understand the lesson but the they did not think

Table 4. The Independent t-test between student studied in semester 1/2022 and 3/2021

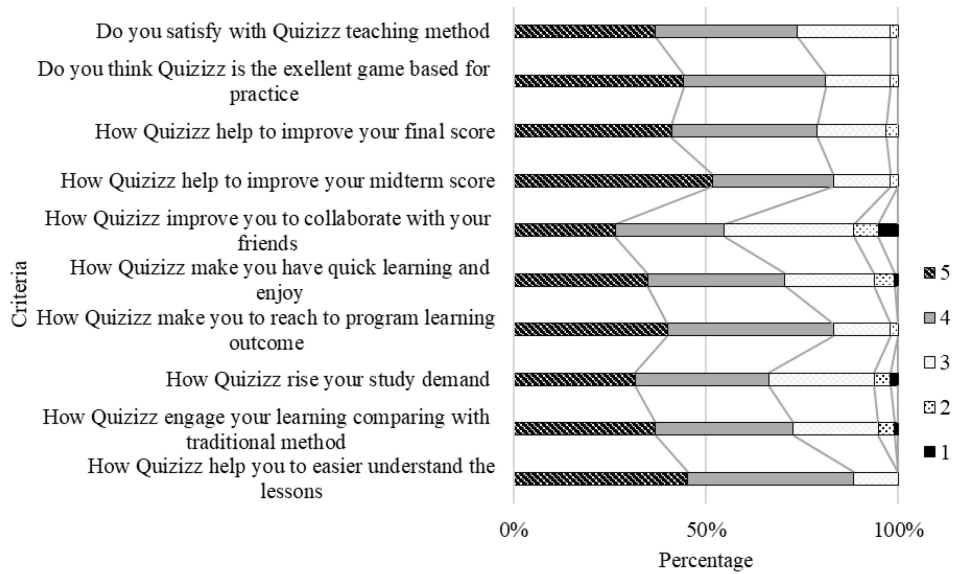| Sample	N	Mean	S.D.	t	Sig.
QUIZIZZ Application	105	51.997	14.120	10.903	0.355
Non-QUIZIZZ Application	207	34.116	13.467		

Fig. 3. Student assessment proportion on QUIZIZZ usefulness in their perspective.
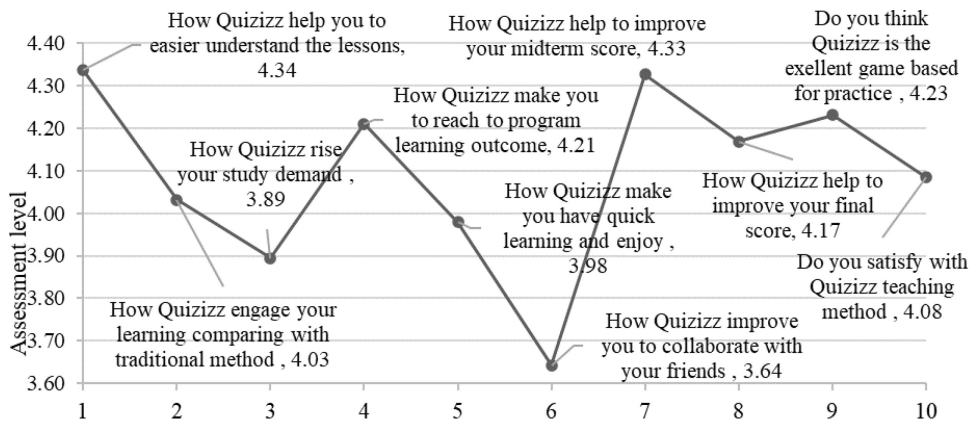

Fig. 4. An Average student assessment level on QUIZIZZ usefulness in their perspective.
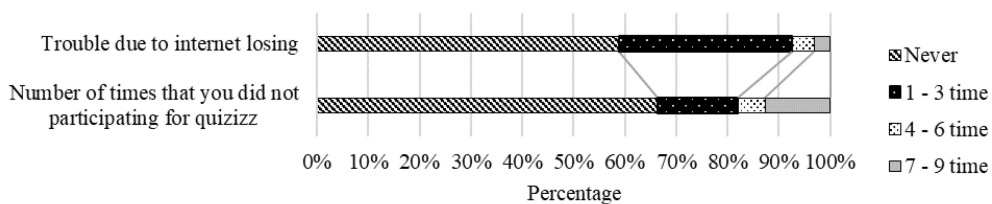

Fig. 5. Student participations.

that QUIZIZZ improve them to collaborate with their friends. There are commonly that students missed joining QUIZIZZ however, more than 60 percent have never missed to participate. Moreover, about 60 percent of students have stability with the internet connection, while about 30 percent have a few time face with internet losing and 10 percent always encountered with internet connection problem shown in Fig. 5.

There are six questions asking for further

improvement both about QUIZIZZ and lesson content shown in Fig. 6. Students of 88.42 percent respond that the content is well planned and prepared. Also students of 81.05 percent rate for the learning objectives are clear. These can be ensured that they percept and agree for the program learning outcome criteria. Students of 80 percent agree that QUIZIZZ encourage student to fully participate. The appropriate amount of contents is agreed with 70.53 percent students and more than half
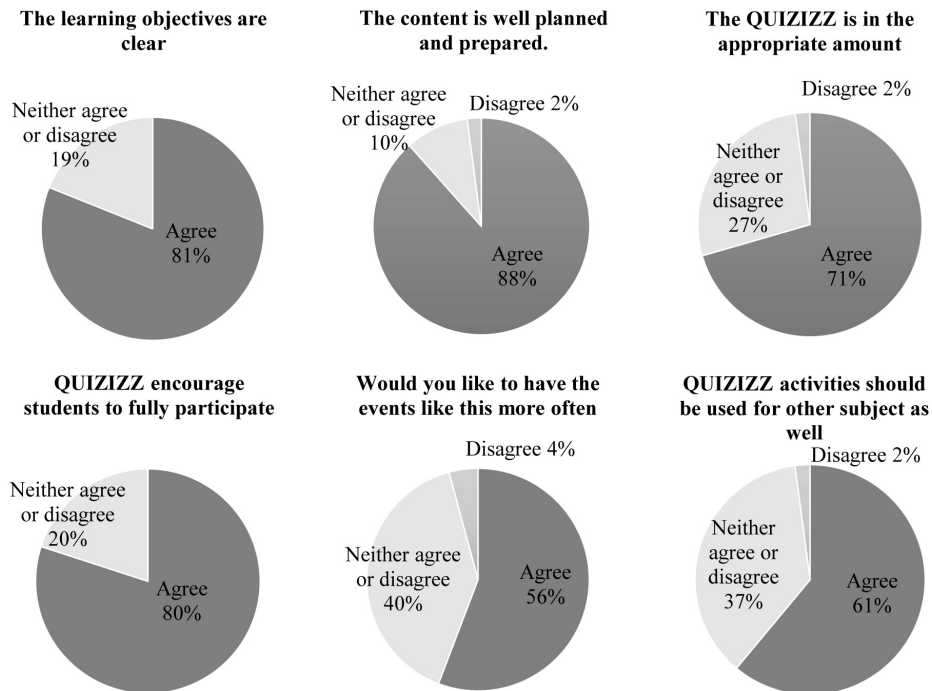
The learning objectives are clear

Neither agree or disagree 19%

Agree 81%

The content is well planned and prepared.

Neither agree or disagree 10%

Disagree 2%

Agree 88%

The QUIZIZZ is in the appropriate amount

Disagree 2%

Neither agree or disagree 27%

Agree 71%

QUIZIZZ encourage students to fully participate

Neither agree or disagree 20%

Agree 80%

Would you like to have the events like this more often

Disagree 4%

Neither agree or disagree 40%

Agree 56%

QUIZIZZ activities should be used for other subject as well

Disagree 2%

Neither agree or disagree 37%

Agree 61%

Fig. 6. Further improvement aspect.

55.79 percent would like to have the QUIZIZZ event more often. Finally, students of 61.05 percent rate that QUIZIZZ activities should be used for other subject as well.

3.5 Student Learning Motivation

Large class students have their different in term of year of study and field of study. Every semester has some or many student losses in their engagement, those students withdraw after a few weeks passed or after seeing the midterm score. The amount of student maintains in the course until the end of semester comparing between the semester 3/2020 and 1/2021 is show in the Fig. 7. The students who have withdrawn in the semester 3/2020 non-QUIZIZZ which mean they have loss motivation to study in this subject is 29.07 percent. Meanwhile, the students who have withdrawn in the semester 1/2021 that is applied QUIZIZZ represents only 7.76 percent. Those over than 20

percent of students can imply that they have chance to rebound their score in case they keep intensive studying.

3.6 Relationship of Formative QUIZIZZ Score and Summative Score of Learning Ability on Engineering Majors

Fig. 8 and Fig. 9 show the comparison between average formative QUIZIZZ score and average summative of midterm and final score. Among all majors of engineering, the Manufacturing Automation and Robotics Engineering, Electrical Engineering and Computer Engineering students are outstanding results for learning ability during the midterm period which are acceptable due to those students familiar more with calculation skill. While the section relevant with material engineering such as Ceramic Engineering, Chemical Engineering, Polymer Engineering, and Petroleum Engineering and Geotechnology students achieve similarly
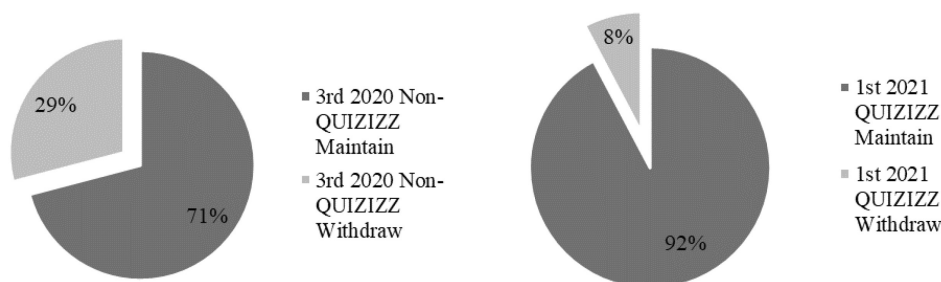
29%

71%

- 3rd 2020 Non-QUIZIZZ Maintain
- 3rd 2020 Non-QUIZIZZ Withdraw

8%

92%

- 1st 2021 QUIZIZZ Maintain
- 1st 2021 QUIZIZZ Withdraw

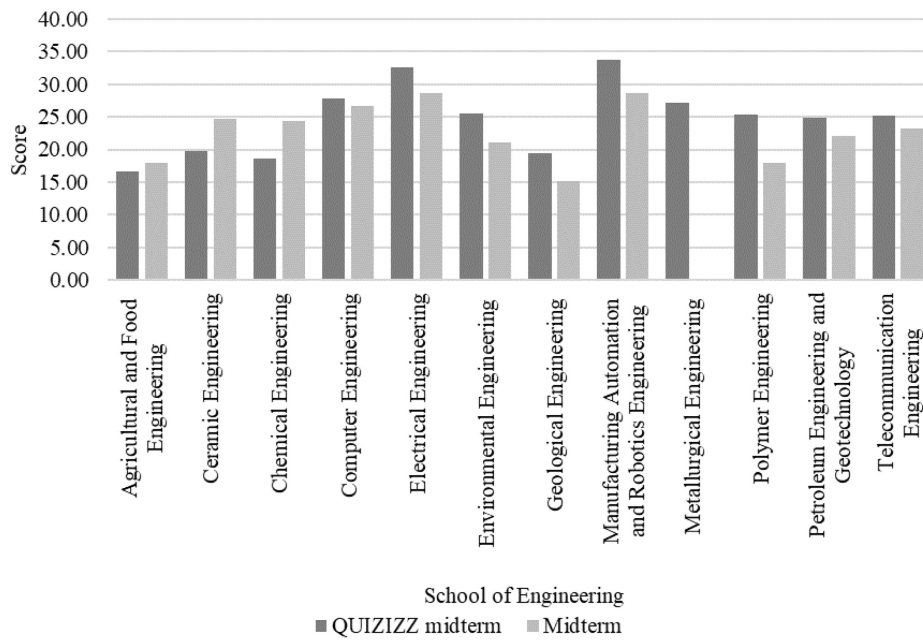**Fig. 7.** Student learning motivation ratio comparison between non-QUIZIZZ and QUIZIZZ.

Fig. 8. Student learning ability relationship of formative QUIZIZZ midterm score and summative midterm score.
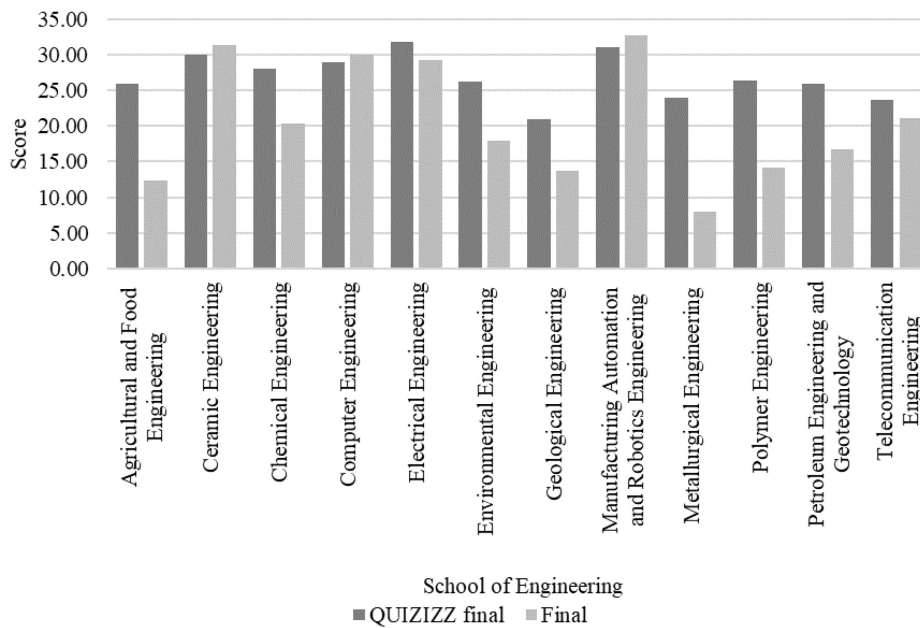

Fig. 9. Student learning ability relationship of formative QUIZIZZ final score and summative final score.

range which can be explained that they have similar skills. However, by enhancing intensively with the gamified learning teaching QUIZIZZ, the relevant of material engineering especially Ceramic Engineering and Chemical Engineering can improve their learning ability equivalent with top three engineering majors in the final period. There is the abnormal case that obviously seen unsuccessfully fail for student in the major of Metallurgical Engineering which has well score for formative QUIZIZZ both midterm and final however, the summative of midterm score is zero and final is very low. The good reason can be defined that this student is not surrender on this subject and the teaching method still encourage. These all finding results can be becoming the important treating guidance to instructors for further focusing students according to their different majors.
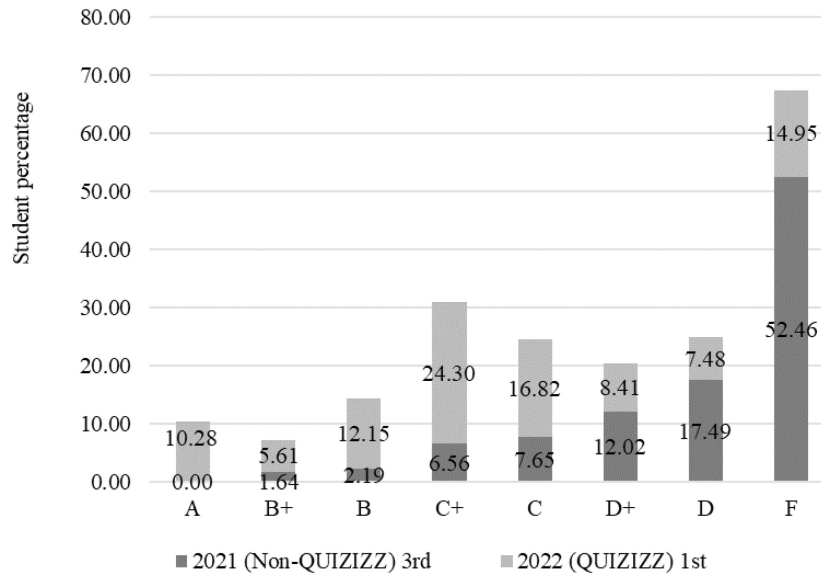
Fig. 10. Student learning performance improvement comparison between non-QUIZIZZ and QUIZIZZ.

3.7 Student Learning Performance Improvement

Students were applied by QUIZIZZ have significantly improve their learning outcome comparing with Non-QUIZIZZ using. There is no student who achieve for the excellent level A in the semester of Non-QUIZIZZ using, while there is 10.28 percent increase in the semester that apply for QUIZIZZ shown in Fig.6. Similarly, in the moderate level and rather moderate level of B+, B, C+, C are also increase 3.97, 9.96, 17.74 and 9.17 percent respectively. While the poor students especially who are failed F has obviously decreased as 37.51 percent. Likewise, the amount of students who receive D and D+ have decreased for 10.01 and 3.61 percent respectively.

4. Conclusion

According to the diversity of students from large class together with less engagement disrupting form freedom accessible devices are obstacle student learning ability. The lecturers need to make an afford to find the better method of teaching aims to gain more student's engagement which can be effect on student's learning outcome. This study is to examine the QUIZIZZ application efficiency after using in Engineering Statics subject. The suitable of statistic test are used including Paired-samples t-test and Independent t-test. Paired-samples t-test use to compare the learning outcome between the QUIZIZZ and midterm in homogenous group. There is the relationship of students who can success during hard study in QUIZIZZ can also achieve in learning outcome. Independent t-test applies for different condition

between using QUIZIZZ Application and Non-QUIZIZZ Application. The average mean of using QUIZIZZ application yield that using QUIZIZZ application can improve student learning ability. Therefore, there are the significant to consider this teaching strategy of active learning applied in this large classroom. Moreover, the satisfactory perspective, the accessible availability participation and the further improvement are asked to percept on student impression due to the reason that student impression is one of the achievement key to operate the large class teaching.

Students satisfy on using QUIZIZZ application and they accept that QUIZIZZ help to easier understand the lessons and help to improve their learning outcome. Also using the internet network connection be a part of this learning method cause only a few time and proportion to participate. Students realize that the content lessons and study objectives according to the program learning outcome are well planned and appropriate delivered to all. As the result that using QUIZIZZ application rises amount of students to maintain through the semester which imply that students have more engagement in their study. Moreover, the student learning outcome has improved showing from the amount of excellent and moderate students have been increased while the poor student become reduced. Finally, students respond that QUIZIZZ encourage them to fully participate which is also one of the keys can be lead students to achieve on effective learning. Therefore, there are the significance to consider using this teaching activity of active learning applied in the large classroom.

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