Effectiveness of E-learning Experience through Online Quizzes: A Case Study of Myanmar Students

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Mon Mon The(✉), Tsuyoshi Usagawa
Kumamoto University, Kuramoto, Japan
monmonthe@gmail.com

Abstract—Universities in developing counties have come to understand that relying on only traditional classrooms is not sufficient to advance students' knowledge and skills. The rapid development of information systems and internet technology has brought many educational innovations that can eliminate the boundaries of conventional teaching and learning. However, universities and their members including students are still experiencing challenges in understanding how to access e-learning practically and what type of direct benefits can be gained before e-learning can be implemented at their universities. Consequently, this study develops a pilot program for e-learning content based on quizzes and delivers that content to inexperienced students. The current work aims to measure the effectiveness of e-learning experiences on students after practicing through online quizzes. The findings indicate that students have better grades on their final post-test, which was taken after self-study and practice with online quizzes. All the third-year students (24 students in total) from the Department of Computer Engineering and Information Technology (CEIT), Yangon Technological University (YTU), Myanmar, participated in these pilot e-learning tests. The paper also examines the relationships among e-learning study-time, number of accesses, the number of online activities, the number of quiz activities and the improvements in outcomes of students. The findings of this research will be useful for the universities from Development in establishing e-learning education.

Keywords—E-learning, Moodle, Online Quizzes, Students, Pre-test, Post-test

1 Introduction

Currently, through use of the internet, teaching and learning processes are becoming updated and teacher-centred education is transforming into student-centred education. Universities are also seeking more effective higher education to enrich traditional instruction and to support better interaction among learners. Presently, e-learning has emerged as an educational supporting tool to build an ICT-based learning environment. It can be defined as the use of internet technology to deliver knowledge and resources to individual learners [1]. Because there are no limitations with regard to place and time, e-learning reduces many boundaries seen in traditional education. It is not a substitute but assistant helpful tool for upgrading traditional teaching and learning processes[2]. In addition, it encourages individual learners or students to expand their self-

study habits. Therefore, increasing number of universities is trying to install e-learning education in their academic systems via the medium of internet connections [3]. The use of e-learning is growing quickly at all level of education in both developed and developing countries, but some universities do not fully understand how to design their e-learning missions or how to assess the changes caused by e-learning[4]. From an educational perspective, it is important to determine whether or not e-learning has a positive impact on students' performance and what issues will be reflected in improved learning outcomes before actual implementation. Further, all possible challenges in the adoption e-learning should be taken into consideration from the development of the pilot e-learning system through its implementation and usage[5].

However, Myanmar, which is one of the least developing countries at present in 2018, has many challenges in the higher education sector, including universities. There is limited access to education, especially to university education and the lack of access leads to wide inequality in higher education[6]. Like other countries, Myanmar realizes that conventional education alone cannot cope with all the demands of education and e-learning will play an important role in developing human resources across sectors[7]. On the other hand, as the popularity of the internet in Myanmar, grows, Myanmar's universities have a better chance and better potential to enhance the quality of the education they provide. For example, because there are many network subscribers, such as Telenor, Ooredoo and MPT, the number of internet users, is rapidly increasing. Due to incredible internet speed, now Myanmar students can access the internet anytime and anywhere. Additionally, e-learning is one of the possible solutions for improving not only Myanmar's higher education but also its economic development[8]. Currently, most Myanmar universities have developed an interest in e-learning education; however, there might be unique barriers to its implementation[8][9]. In addition, e-learning helps universities, that do not have enough teachers and encourages collaboration between teachers and students [10][11]; hence, it can facilitate knowledge sharing among Myanmar students. By using the internet, up-to-date educational resources via e-learning are available anytime and anyplace. Therefore, Myanmar universities can ensure equality in higher education between universities located in rural areas and urban areas.

However, confirming the effectiveness of e-learning for Myanmar students is vital before actually implementing e-learning in Myanmar universities. Mon Mon The et al. (2017) reported on e-learning readiness in the Center of Excellent (COE) technological universities of Myanmar and measured the attitudes of 1024 students, including 326 students from Yangon Technological University (YTU)[12]. They found that YTU students have positive attitudes regarding the adoption of e-learning education. As key barriers, IT competency, the speed of the university network, the habit of having a shared vision among the students, budgets and e-learning tutorials were also investigated. Moreover, the supply of electricity is inconsistent for 24-hours, and it remains the key challenge (for example, in YTU). With regard to the limitations of technology, infrastructure, and educational policies, including the intellectual property of learning materials, the implementation of e-learning education in Myanmar universities needs to be carried out prudently. Subsequently, prior to the adoption of e-learning on campus, Myanmar universities need to establish pilot e-learning courses to their educational framework well. In consideration of the above issues, the authors built an e-learning

pilot system, and the effects of the e-learning experiences of YTU students were evaluated. This pilot e-learning program is delivered by the server located in Kumamoto University, Japan, so YTU student can access the e-learning contents from anywhere the network is available. This paper is structured as follows: Methodology, Results, Discussion and Conclusion.

2 Methodology

In this section, the objective of the study, selection of the course and the participants, implementation of the course contents, communication with students for mentoring, data collection on Moodle and questionnaire-based survey were organized.

2.1 Objective of the Study

The key objective of current study is to evaluate the effect of the e-learning experience on students from YTU, Myanmar. For this, two online tests were created, and quizzes were set up into two tests. Then, hypotheses were established as follows.

- The null hypothesis, H_0: there is no difference in the mean of the pre-test and post-test grades.
- The alternative hypothesis, H_1: there is a difference in the mean of the pre-test and post-test grades.

Moreover, this study considers to measure student e-learning attitudes before and after e-learning experience. Besides, it takes into account the relationship of student performance and online activities.

2.2 Selection of the Course and the Participants

Among seven courses; Applied Mathematics V, Programming Language III, Data Structure & Algorithm I, Operating System I, Electronic Circuit & Device, Database Management System I and Data Communication and Networking I, the "Data Structure and Algorithms Analysis I" course was chosen for the educational e-learning content to design multiple-choice quizzes. This subject is compulsory for all students taking classes in the first-semester of their third-year (the fifth-semester of a six-year degree program). The contents of the quizzes were designed based on the textbook, referenced books, past exam questions, and the syllabus for Data Structure and Algorithms Analysis I, which is currently being taught by the Computer Engineering and Information Technology (CEIT) Department. To ensure the veracity of the contents, the authors confirmed all the contents with the class and subject teachers from YTU. Online quizzes were aimed measuring the students' knowledge and achievement in their lectures, which they had already learnt in their YTU classroom. A period of 3 months, from October 2016 to December 2016, was used to create quizzes and confirm the contents of those quizzes with YTU teachers. Finally, the subject and classroom teachers

remarked that quizzes are very convenient for their students to prepare for the academic exam.

At present, YTU has 12 engineering departments and 6 supporting departments. As YTU is a COE technological university of Myanmar, its yearly accepted rate is only 250 students for all the engineering departments[13] but currently, the acceptance rate increases up to 300 students. All the third-year students in the Department of CEIT participated in this study. In total, 24 students (Female = 13 and Male = 11) had no previous e-learning experience, but all the students joined this study and finished the tests.

2.3 Implementation of the Course Contents

In building e-learning contents, there are many open-source learning management systems (LMSs), such as Moodle, ATutor, Dokeos, Eliademy and Formas LMS. LMSs are used in many educational organizations because of benefits such as economic value, easy access, a free charge for redistribution privileges, flexibility and customizability [14].In addition, those platforms have many capabilities to help universities and teachers with a variety of educational goals, such as creating course contents, course delivery and effective course updates; allowing participants in a course to communicate with each other, and assessing participants' activities. Among the many open source LMSs, Modular Object Oriented Dynamic Learning Environment (Moodle) was identified as one of the worlds' most used LMSs, and hence, its number of users from 234 countries has increased to over 122 million[15]. Moodle is easy to use and provides dedicated built-in features for learning. Because of the low cost, flexibility and other advantages, many universities and schools from developed and developing countries use Moodle to satisfy their own teaching and learning demands[16]. For this reason, Moodle was used to create the pilot e-learning contents for the CEIT students. In this pilot e-learning system, the authors ensured that students were able to practice through e-learning quizzes as well as learn the e-learning contents related to their lectures.

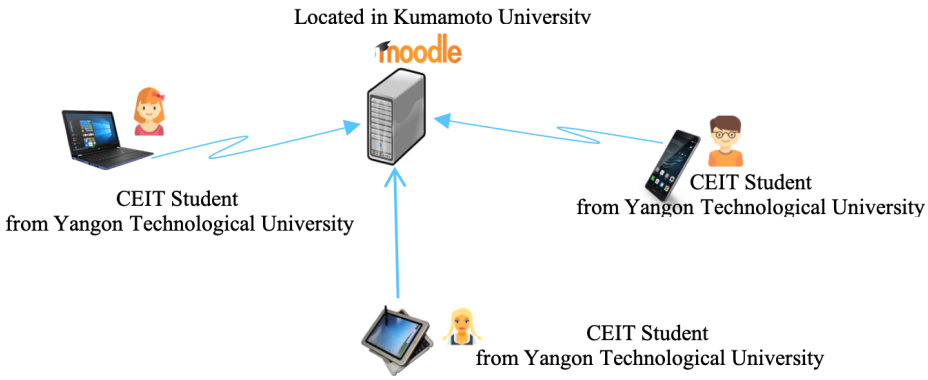

Fig. 1. YTU Students' Access to the Moodle

However, building and sharing e-learning contents through the CEIT server still presented some barriers. The current server of the CEIT Department, which is a local server connected to the YTU public server, can provide students with access to the internet via Wi-Fi and LAN cables in department areas only. In addition, accessibility is permitted during office hours only because the server is also shut down outside of working hours and days. This situation indicates the place and time limitations of the CEIT server still remain as key barriers to establishing e-learning education at CEIT. For this reason, the development of the contents and quizzes were built in a Moodle server located at Kumamoto University (KU), Japan so the CEIT students could access this server anytime and anyplace they desired (see Figure 1).

A quiz schedule was set up so that for each test the participants had to take 10 randomized quizzes from a quiz bank, which stored 176 quizzes. Among the two online tests, the pre-test was intended to confirm the students' current knowledge after their lectures. However, the post-test was designed to measure whether the students could self-study after knowing their pre-test grades and whether they could increase their pre-test grades in a post-test. Students needed to be flexible in sitting the test, and so they were permitted to take the two tests at any time during a scheduled three-day period.

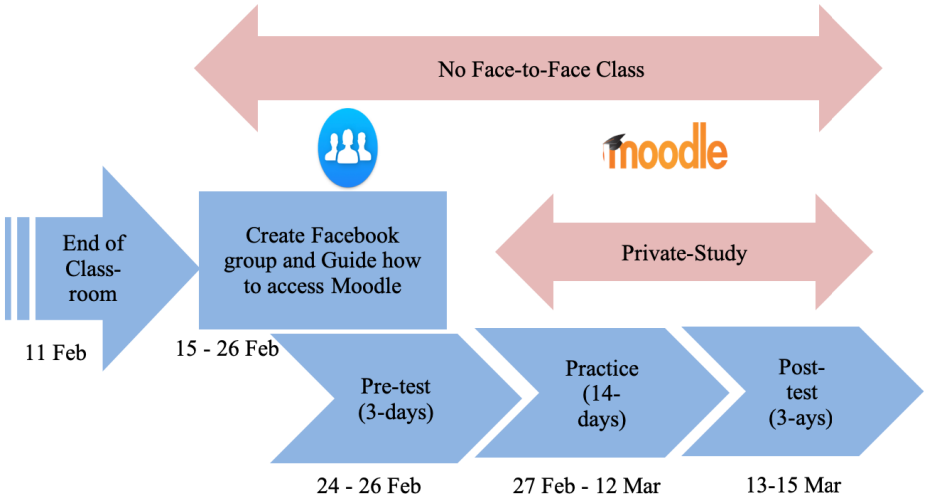

Fig. 2. Timeline for the Pre-test, Practice and Post-test

For the first-semester of the third-year which started in November 2016 and ended in March 2017, face-to-face lectures on "Data Structure and Algorithms Analysis I" were finished early in the third week of February. So, as shown in Figure 2, the two tests were timed to be taken before and during private study, in the last week of February and the third week of March 2017 respectively. According to the university's academic schedule, private study means the period of time before the first-semester exam and at the end of the first-semester lectures. Teachers have to complete their lectures, including revisions, before the private study. Consequently, the private study also means when there is a no face-to-face class lecture.

Although there was a time limitation for the submission of the pre-test and post-test, practice before the post-test was not limited. The reason for this approach was to encourage students to access the online quizzes and develop learning habits via Moodle. Depending on their choice of quiz, students could get different types of feedback immediately (e.g., "Your choice is right", "You can do it", "Now your choice is wrong. Try again next time", and "I hope you will get a better grade next time"). The results of the tests were also designed so that every student could see their individual grades for the pre-test, practice and post-test. By knowing their grades, he students could control their learning both online and offline themselves.

2.4 Communication with Students for Mentoring

Prior to the start of e-learning, connecting via Moodle was moderately difficult for students who had no experience with Moodle or e-learning courses[17]. In the first stage, to connect with the students, the authors decided to use Facebook, which supports the easiest communication. Because Facebook is the most popular social media site in Myanmar, its user rate is 93.99%, while users on other social media are total 1.84% on YouTube, 1.81% on Twitter, 1.76% on Pinterest, 0.15 on Tumblr and 0.14% on Google[18].

YTU students have a great deal of experience accessing, chatting and discussing via Facebook. Therefore, a Facebook group was created to communicate with the participants and guide them through the installation so that their different devices could access our e-learning course well. From February 2017, the authors tried to develop a strong connection with the students in both English and Myanmar languages. Before delivering instructions about Moodle-based learning, the internet service and devices used by the participants were also identified via Facebook communication. As personal facilities, all the participants had already owned personal computers and mobile phones. Moreover, one of students had tablet/pad and four of them had e-book readers.

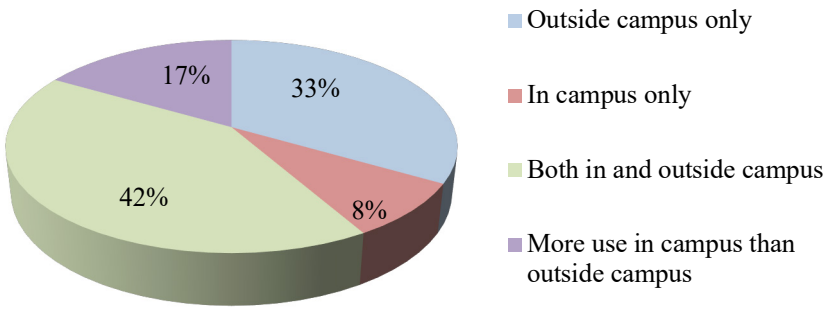

Fig. 3. Pre-study of Participants' Internet Access(Location)

Figure 3 illustrates that all the students accessed the internet daily, both in and outside the campus. Moreover, Figure 4 shows the internet services used by students and there is no student who used only the campus internet service. The results of Figure 3 and Figure 4 indicate to the authors about the possibility that students can access Moodle. Then, via the Facebook group, students were encouraged to solve their problems accessing the e-learning course and become familiar with Moodle. Finally, all the third-year students from the Department of CEIT agreed to participate in our study.

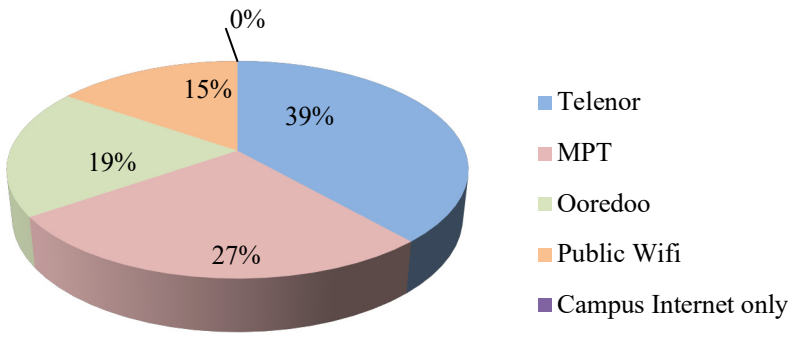

Fig. 4. Pre-study of Participants' Internet Access(Service)

2.5 Data Collection on Moodle

There were two parts of the data collection: data from the log file generated by Moodle and data from the questionnaires. First, data on student activities from the Moodle log were monitored. Moodle's logging system stores an active log of student activities, and the authors tried to keep track of what actions students accessed and when. Log data from 24 February to 15 March were obtained and assessed. To compare grades between tests, individual grades produced by Moodle's grade plug-in were evaluated.

2.6 Questionnaire-based Surveys

This study learnt the changes before and after the e-learning experience and online questionnaires about e-learning readiness were also delivered to all the students. Those questionnaires adapted an assessment instrument previously developed by Sary Paturusi et al. [19]. To determine the adequacy of their e-learning attitudes, totally 40 questionnaires were shared with 24 students before the pre-test and after the post-test. The participants assessed the accuracy of the questionnaires by using a Likert scale, where 1 = 'totally disagree', 2 = 'disagree', 3 = 'neither agree nor disagree', 4 = 'agree' and 5 = 'totally agree'.

3 Results

This section of the paper is organized in the following order: data analysis, analysis of the improvement in the Moodle grades, analysis of the relationship of Moodle's logs and the evaluation of changes to responses the questionnaires.

3.1 Data Analysis

The data analysis was carried out using descriptive statistics, means and standard deviations. To identify the effectiveness of the e-learning experiences by online quizzes, a dependent approach known as a paired t-test was applied. To statistically test the validity of the pairs, a correlation coefficient was calculated for each pair using a Pearson approach. In addition, student feedbacks were evaluated before and after e-learning experience, and a significance level of 0.05 was considered. Although the number of students is only 24 and monitoring period is short, the authors found that there were many online activities (see Table 1).

Table 1. Activities on Moodle

Activity	Number
Badge listing viewed	2
Course module viewed	1578
Course user report viewed	6
Course viewed	566
Discussion viewed	6
Grade overview report viewed	6
Grade user report viewed	79
Quiz attempt abandoned	10
Quiz attempt reviewed	1072
Quiz attempt started	975
Quiz attempt submitted	959
Quiz attempt summary viewed	989
Quiz attempt viewed	10384
User graded	1789
User list viewed	55
User profile viewed	25
User report viewed	2

3.2 Analysis of the Improvement in Moodle's Grades

During the two tests, students showed improvement in their grades after the e-learning experience. According to the results shown in Table 2, the mean for the post-test improved from 45.5 to 93. In Table 3, the paired t-test indicates that the significant difference between the two tests is 0.000 with a mean difference of 50.83. Since $p < 0.05$(in fact p=0.000), the null hypothesis (H_0) is rejected and the alternative hypothesis

(H_1) is confirmed. This provides strong evidence that student grades increased statistically higher in their final test(post-test) than their first test(pre-test).

Table 2. Paired t-Test Statistics of Pre-test and Post-test

	Mean	**Std. Deviation**	**Std. Error**
Pre-test	42.5	22.5	4.6
Post-test	93.3	12.7	2.6

Table 3. Paired Difference between Pre-test and Post-test Grades

Pair	**Mean**	**Std. Deviation**	**Std. Error Mean**	**95% Confidence Interval of the Difference**		**t**	***p*-value**
				Lower	***Upper***		
Pre-test & Post-test	50.8	29.5	6.0	63.3	38.4	8.4	0.000*

* $p < 0.05$

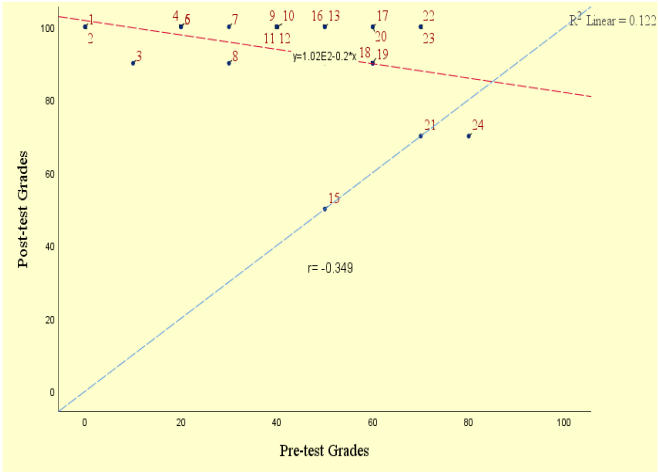

Fig. 5. Scatterplot of the Post-test and Pre-test Grades

In Figure 5, the red numbers represent the individual students, and the arrangement of their pre-test grades. The findings indicate that all the students had improved better outcomes at the post-test, except for three students with the roll numbers: 15, 21 and 24 whose scores remained stable between the two tests. In addition, the Pearson correlation between the two tests shows a weak and negative correlation with the value of r = -0.349 and a significant value of $p = 0.095$. Moreover, the red fitted line confirms an inverse relationship with the r-square value, 0.122. This also reveals that the students' grades in the post-test are better than pre-test after taking the online quizzes. There might be several reasons for this; however, one possible reason is that the junior students already learned their subject themselves so that they could get better grades in the next quiz practices.

3.3 Analysis of the Relationship of Moodle's Logs

Table 4. Activities for Measuring the Relationship

Activity	Number
Time (min)	5791
Hits	18484
Quiz Activity	14389
Total Activity	18503

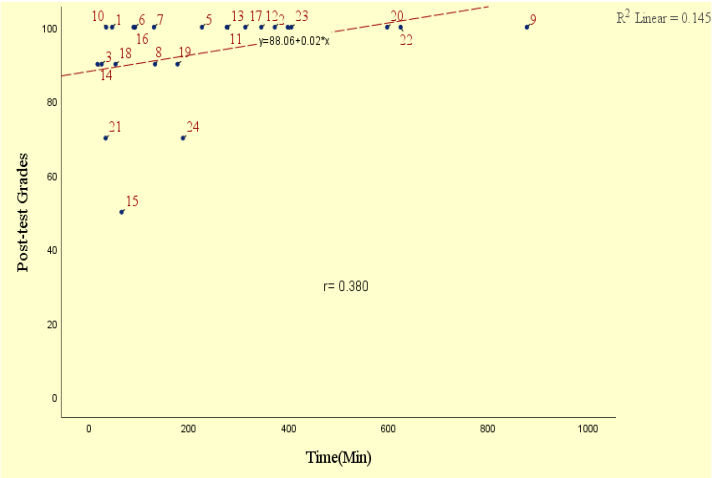

Fig. 6. Scatterplot of the Post-test Grades and Online Study-Time

Many researchers in the e-learning field study the factors that can influence students' performance. In our case, the authors intended to evaluate the online activities occurred during the pilot e-learning program and to determine which activity had the highest relationship with the post-test grades. Therefore, relationships based on log data from Moodle were measured. During the monitoring periods, different types of activities and their corresponding data were obtained (see Table 4). Then, depending on the access time, number of hits, number of quiz activities and number of total activities produced by individual participants on Moodle, the correlation was calculated. During the pre-test to post-test period, students had different time ranges and their time spent on Moodle was measured. Figure 6 specifies the relationship between their post-test grades and their duration (min) of their study-time on Moodle after the pre-test and before the post-test. The red fitted line (with $R^2 = 0.145$) implies that there is a linear relationship, although it is not strong. Moreover, the Pearson correlation ($r = 0.380$, $p = 0.067$) shows a positive relationship. Moreover, the result in Figure 6 states that every student receives the highest grade if their study-time is over 200 minutes.

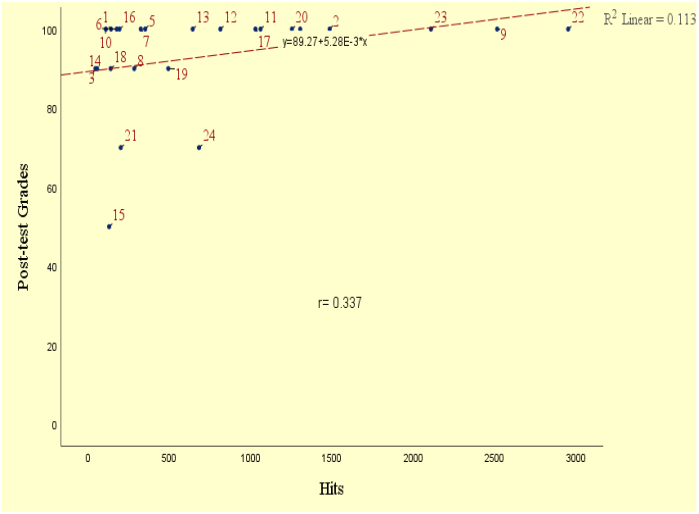

Fig. 7. Scatterplot of the Post-test Grades and Number of Hits

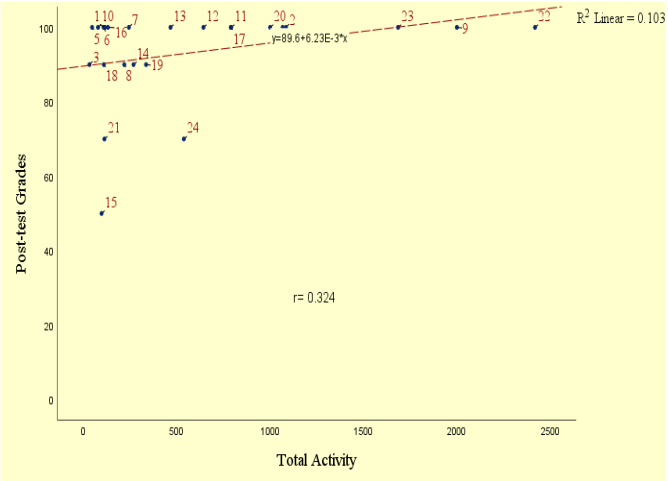

Fig. 8. Scatterplot of the Post-test Grades and Total Activities

Figure 7 displays to what extent the students' post-test grades are related to their daily hits on Moodle on the practice days. According to the result of the Pearson correlation (r = 0.337, p = 0.108), they have a positive and weak relationship. The red regression line (with R^2 = 0.113) expresses the linear association between hits and post-test scores. This relationship is moderate and is weaker than the relationship between their grades and their time spent on Moodle.

Figure 8 checks the relationship between students' post-test grades and their total activities. The red fitted line (with R^2 = 0.105) demonstrates their linear relationship, and the Pearson correlation (r =0.324, p = 0.123) displays the positive communication,

although even it is weak. However, the relationship between students' grades and their total activities is still weaker than the one between their grades and number of hits. In addition, the authors considered whether only quiz activities can affect students' post-test grades and, subsequently, their relationship was evaluated by applying the Pearson correlation approach. Figure 9 shows the Pearson correlation coefficient($r = 0.321$, $p = 0.126$) and the regression lines (with $R^2 = 0.103$). This indicates that the post-test grades are linearly correlated with quiz activities. However, amazingly, only students' quiz activities are weakly correlated with improved grades if their total activities on Moodle are compared.

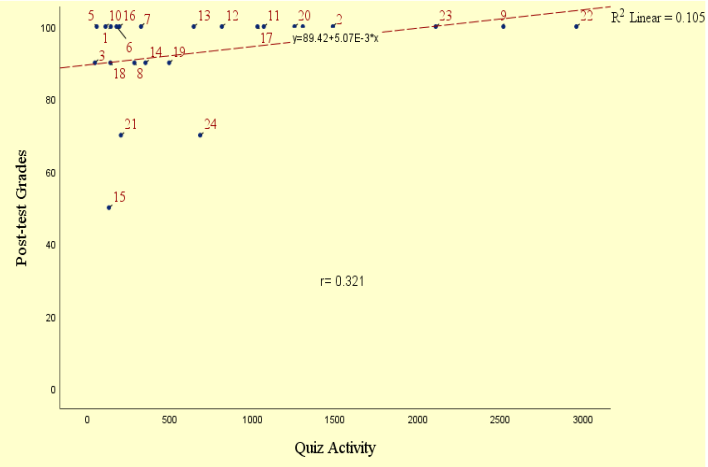

Fig. 9. Scatterplot of the Post-test Grades and Quiz Activities

3.4 Evaluation of Changes to Response to the Questionnaires

To implement e-learning education, the positive perception of individual students is important, and their attitude is also linked with their intention to use e-learning. This study tried to check whether or not students' attitudes remain the same after using e-learning. Consequently, before students accessed Moodle, they were given questionnaires about their e-learning readiness. After they completed the post-test on Moodle, the same items were shared again and their changed feedbacks was assessed.

After the e-learning experience, Table 5 displays the changes to participants' e-learning characteristics. In all the items from Q_1 to Q_{14}, except Q_5, significant differences were found before and after the online experience. Q_1 and Q_2 indicate that students received better e-learning knowledge and were more eager to integrate e-learning than before. In Q_3, the students began to know that their current IT competency was enough for e-learning. According to Q_4, student enjoyment of their access to e-learning lessons increased. In Q_5, student computer usage at home seemed to remain stable. However, according to Q_6, students increased their computer usage on campus. In other words, the results indicate that an e-learning experience can encourage students to broaden their learning area and increase their learning time. The results on Q_8 , Q_9 and Q_{10} also

indicate that students' individual responses were increased. The students were more willing to make time, to buy a computer and to spend extra money for the purpose of e-learning. In addition, the mean of Q_{11} also improved significantly. This is an indicator that participants were becoming more confidence solving technical problems. The items for Q_{12} indicate that students were more interested into improving their performance through e-learning. According to Q_{13}, student self-confidence to drive their learning themselves improved. Finally, according to Q_{14}, students' readiness significantly improved after the e-learning experience.

Table 5. Responses Regarding the E-learning Characteristics of Participants

No.	Questionnaires	Mean		Std. Deviation		t	*p*-value
		Before Pre-test	***After Post-test***	***Before Pre-test***	***After Post-test***		
Q_1	E-learning knowledge	3.8	4.1	0.7	0.7	3.4	0.003*
Q_2	Ready to integrate	3.6	4.0	0.5	0.5	3.4	0.003*
Q_3	Have enough IT competency	3.5	3.6	0.5	0.5	2.1	0.043*
Q_4	Prefer e-learning lessons	3.4	3.7	0.9	1.0	3.4	0.003*
Q_5	Use computer at home	3.8	3.9	0.7	0.6	1.4	0.162
Q_6	Use computer at campus	3.5	3.7	0.7	0.6	2.1	0.043*
Q_7	Own personal computer/laptop	4.1	4.2	0.7	0.6	1.8	0.083
Q_8	Willing to make time for e-learning	3.5	3.9	0.5	0.5	3.1	0.005*
Q_9	Willing to buy computer	2.9	3.0	0.9	1.0	2.1	0.043*
Q_{10}	Willing to spend extra money	2.9	3.3	0.8	0.6	3.4	0.003*
Q_{11}	Can overcome technical problem	3.1	3.5	0.5	0.5	4.1	0.000*
Q_{12}	Improve work performance	3.8	4.2	0.4	0.4	3.7	0.001*
Q_{13}	Discipline myself to follow e-learning courses	3.1	3.5	0.9	0.9	2.6	0.017*
Q_{14}	Overall, ready for e-learning	3.3	3.8	0.8	0.7	3.1	0.005*

*$p < 0.05$

In regard to e-learning readiness, participants' responses regarding their university's facilities are shown in Table 6. After the online tests, significant improvements were detected in only five items, which referred to technical issues such as technician, training, tutorial and technical support. Amazingly, students expressed their improved mindset regarding Q_{21}. The students thought that the IT competency of the IT manager or coordinator from their university was sufficient to provide e-learning. In our opinion, participants might assume the instructor who gave the instructions about the e-learning installation via Facebook is their IT coordinator. In addition, after knowing about the instructor's responsibilities directly, the students' faith in the YTU technicians increased; the statistical result of Q_{23} describes the difference in student attitudes before and after the e-learning experience. All the students knew that although their university and department could not possibly deliver 24-hr online courses to them, the university did give permission for them to access the e-learning contents shared by KU. Therefore, students' option of their university seemed to improve. For that reason, their responses

in pairs of Q_{24}, Q_{25} and Q_{26} also changed significantly after accessing the e-learning tests.

Table 6. Responses Regarding the E-learning Readiness of the University

No.	Questionnaires	Mean		Std. Deviation		t	p-value
		Before Pre-test	*After Post-test*	*Before Pre-test*	*After Post-test*		
Q_{15}	Departments' number of computers	3.2	3.2	0.8	1.0	0.0	1.000
Q_{16}	Computers' quality is good	2.96[a]	2.96[a]	0.9	0.9		
Q_{17}	University network is fast	2.71[a]	2.71[a]	0.9	0.9		
Q_{18}	University's IT infrastructure	3.1	3.0	0.7	0.8	1.8	0.083
Q_{19}	Overall, IT infrastructure can support e-learning	3.1	3.0	0.8	0.9	1.8	0.083
Q_{20}	University's budget	2.7	2.8	0.8	0.8	1.4	0.162
Q_{21}	IT competency of university IT manager	2.8	3.0	0.7	0.8	2.1	0.043*
Q_{22}	IT competency of university IT technician(s)	3.0	3.2	0.6	0.7	2.1	0.043
Q_{23}	Number of university IT technicians	2.8	3.0	0.7	0.7	2.8	0.011*
Q_{24}	University provides enough training	3.0	3.2	0.7	0.8	2.1	0.043*
Q_{25}	University provides enough tutorial	3.1	3.3	0.5	0.6	2.1	0.043*
Q_{26}	Overall, university technical support is adequate	2.8	3.1	0.7	0.8	2.8	0.011*

*$p < 0.05$
a. The correlation and t cannot be computed because the standard error of the difference is 0.

The questions in Table 7 demonstrate the students' opinions towards their faculty, including colleagues and lecturers. The findings reveal that the students' responses shifted after taking the pilot tests, and two significant differences were found. Except for Q_{27} and Q_{35}, there were no significant changes. In Q_{27}, students responded that their colleagues were also gaining more e-learning knowledge than they had before. At the same time, the students also recognized the importance of the personal touch, which could encourage them to have better educational relationships with teacher and/or with students. Therefore, the students' answers to Q_{35} changed.

With regard to academics, the questions in Table 8 are intended to understand students' attitudes about the benefits of e-learning and three of the five items reveal significant changes after the online quizzes. The authors found that the participants felt more favourably about e-learning and replied more positively on Q_{36} and Q_{37} as well. Finally, in Q_{40}, the students urged their university to start e-learning.

Table 7. Responses Regarding the E-learning Readiness of the Faculty

No.	Questionnaires	Mean		Std. Deviation		t	*p*-value
		Before Pre-test	***After Post-test***	***Before Pre-test***	***After Post-test***		
Q_{27}	Colleagues' e-learning knowledge	3.5	3.8	0.5	0.4	3.4	0.003*
Q_{28}	Colleagues' IT competency	3.4	3.5	0.6	0.5	1.4	0.162
Q_{29}	Colleagues' shared vision	3.4	3.1	0.8	0.8	1.0	0.314
Q_{30}	University's sharing and teamwork culture	3.3	2.9	0.6	0.8	1.5	0.142
Q_{31}	Lecturers' readiness	3.2	3.0	0.7	0.7	0.7	0.517
Q_{32}	Effectiveness of face-to-face	3.8	3.5	0.8	0.9	2.0	0.056
Q_{33}	Discussion via internet	3.0	3.2	0.8	1.0	1.0	0.328
Q_{34}	Lecturers' role in information providing	3.7	3.8	0.8	0.6	0.8	0.426
Q_{35}	Personal touch's importance in e-learning process	3.8	4.0	0.7	0.6	2.8	0.011*

*$p < 0.05$

Table 8. Responses Regarding E-learning Benefits

No.	Questionnaires	Mean		Std. Deviation		t	*p*-value
		Before Pre-test	***After Post-test***	***Before Pre-test***	***After Post-test***		
Q_{36}	E-learning's advanced mode in teaching and learning	3.5	3.8	0.8	0.8	2.3	0.032*
Q_{37}	E-learning's efficience of disseminating information	3.4	3.8	0.6	0.7	2.8	0.009*
Q_{38}	E-learning's improvement for teaching and learning	3.9	4.0	0.5	0.4	1.4	0.162
Q_{39}	E-learning's opportunities	3.2	3.3	0.8	0.8	1.4	0.162
Q_{40}	Right time to promote e-learning	3.2	3.6	0.8	1.0	3.1	0.005*

*$p < 0.05$

4 Discussion

Quizzes are useful tools to enhance learning and consolidate what has been taught [20]. However, classroom-based or paper-based quizzes have many limitations, such as taking a great deal of time to generate them, grade them and provide timely feedback to students. Moreover, this method is unable to produce randomized quizzes or multiple practice experiences. From the standpoint of the delivery cost, paper-based quizzes are costly to write and mark, while online quizzes have a marginal cost close to zero[21]. Ozarslan and Ozlem Ozan (2016) studied two student groups and noted that students who took self-assessment quizzes regularly had higher grades on their final exam than students who did not have any experience with online quizzes[22]. Like Ozarslan and Ozlem Ozan, there are many researchers who have compared student performance by separating students into groups, such as control and uncontrolled groups or online and offline groups. However, to understand e-learning experiences through online quizzes,

the authors did not divide the student into groups; instead, this study compared the same students and their improvement, based on their grades from online quizzes.

Jennifer Hillman (2012) recommended setting the number of quiz attempts and the time for them is a better method for encouraging students to read online quiz material during the allowed time and be ready for their final exam[23]. In our study, three attempts were allowed, but to get undisputed result for measuring the student grades, their grades were collected and calculated from the first attempt only. Moreover, for each test, the students had to select ten randomized questions from among one-hundred and seventy-six questions in seven minutes. However, in the practice periods after the pre-test and before the post-test, there was no the limitation on the number of attempts or the amount of time for randomized online quizzes.

Our finding of the positive relationship between time spent on Moodle and student grades agrees with that of II-Hyun Jo et al. (2015) who indicated that total study-time in the LMS is postively related to student grades[24]. Besides, the findings of this study are in line with Damian S. Damianov et al. (2009) who investigated a positive relationship between study-time and grades for online courses[25], Con Korkofingas el al. (2013) who displayed an association between online study-time and the higher performance of students[26], and Bernt Arne Bertheussen et al. (2016) who said that student grades are related to the time they spent in different online activities in digital learning[27]. Moreover, in current study, author founds that students who spent over 200 minutes on Moodle got the highest grades on the final test.

All students showed increased grades in the post-test, although three students remained stable. Those three students could access Moodle well and took all the tests stored in Moodle. There are many possible reasons for this difference, including their interest in the subject and the amount of their free time but the authors assume that technology is not a reason. Richard M. Felder et al. (2005) also stated that no students are alike and the extent to which students can learn is related to their native ability, background, interests, strengths and weakness, learning styles, ambitions and so on[28]. Timothy Rodgers (2008) displayed evidence that personal-characteristics are related differences in the effectiveness of the online teaching process[29]. Moreover, Alert John et al. (2016) also remarked that each individual is a unique learner[30].

With regard to students' online activities, the findings of our study agree with those of Shu-Fen Tseng et al. (2016) who noted that students' e-learning performance varies by their learning engagement and participation in learning activities[31], and Stamm, Randy Lee (2013) who found a positive relationship between students' performance and their total number of action on the LMS[32]. In measuring the hit relationship, our results reinforce the arguments by Mehmet Firat (2016) who said that there is no relationship between students' achievement on the LMS and the number of total logins/total hits on the LMS. However, Firat also said that the time spent on the LMS is related to student achievement[33]. Unlike other studies, the current study revealed an association between time spent and students' performance in e-learning, and this relationship is stronger than the relationships of student performance with their total number of activities, their quiz activities and their number of hits in e-learning.

5 Conclusion

This study examines the impacts of an e-learning experience through online quizzes on students from YTU, and the authors assessed their grades and all their online activities between a pre-test and a post-test. With regard to limitations, the period for monitoring the students' online activities was not long, and the numbers of students was small. As this study was intended to ascertain the effect of online quizzes on students, the effect of their offline studies was not taken into account. However, the findings reveal that the students got better grades on the post-test than the pre-test after online practices.

At all universities, including the technological universities in Myanmar, students are familiar with classroom-based or paper-based quizzes and tests only. This study exposes that the use of online quizzes is highly beneficial as a method of improving student learning. Along the same line, the results of the statistical analysis on the grades of the pre-test and post-test are shared with the teachers in order to improve the quality of lectures and e-learning contents for coming semesters. Moreover, this research also indicates that, compared traditional face-to-face education, in the online-based learning environment it is easier for teachers and instructors to monitor the learning behaviour and performance of their students. In other words, e-learning helps for instructors and teachers to emphasize the diversity of individual learners and encourage each learner to achieve better learning outcomes, not only in the classroom but also online.

In addition, the study also sought to understand whether students changed their perception of their e-learning readiness situation even after they were familiar with e-learning. According to the results on e-learning readiness, the students were motivated by the e-learning experience. In addition, students' technical skills and confidence in accessing e-learning also increased. For this reason, not only students from other departments at YTU but also students from other universities in Myanmar should be trained and equipped to use e-learning resources to improve traditional face-to-face teaching. This study is also foundational research necessary for the future development and implementation of e-learning at Myanmar universities. Fundamentally, the authors show that e-learning experience through online quizzes is effective for teaching and learning of an academic subject.

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8 Authors

Mon Mon The graduated with an M.C.Sc degree from the University of Computer Studies, Yangon (UCSY), Myanmar, in 2009. From 2007 to 2012, she worked as a demonstrator/tutor at the University of Computer Studies, Yangon (UCSY), the University of Computer Studies, Sittway (UCS-Sittway), and the University of Computer Studies, Pyay (UCS-Pyay). Then, she worked as a lecturer, and she joined the MCC Training Institute (Yatanarpon Cyber City) and the MCC Training Institute (Mandalay) until 2014. Currently, she is a PhD student at Kumamoto University. She is interested in statistical planning and analysis.

Tsuyoshi Usagawa joined Kumamoto University in 1983 right after he received an M.E. degree from Tohoku University. In 1988, he received a Dr. Eng. from Tohoku University. Since 2004 he has been a professor, and he is a member of the IEEE, ASA, ASJ, INCE/J, JSET and JSAI. He is interested in e-learning contents and systems, and acoustic signal processing.

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