

Ubiquitous Learning vs. Electronic Learning: A Comparative Study on Learning Activeness and Learning Achievement of Students with Different Self-Regulated Learning

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I Kadek Suartama (✉)

Universitas Pendidikan Ganesha, Singaraja, Indonesia
ik-suartama@undiksha.ac.id

Punaji Setyosari, Sulthoni, Saida Ulfa
Universitas Negeri Malang, Malang, Indonesia

Muhammad Yunus
Universitas Syiah Kuala, Banda Aceh, Indonesia

Komang Anik Sugiani
Politeknik Ganesha Guru, Denpasar, Indonesia

Abstract—This research examines the effect of ubiquitous learning strategies using various self-regulated learnings on learning activeness and learning achievement of student in higher education. Quasi-experimental pretest-posttests with non-equivalent control group design is used as the method of this research. The subjects of this research are 113 students. The instrument used to measure the students' learning activeness is a learning activeness questionnaire developed by the researcher referring to the theory of learning activeness by Sardiman, whereas objective test is to evaluate students' learning achievement, and online self-regulated learning questionnaire (OSLQ) as adapted from Barnard is utilized to measure the self-regulated learning of the research subjects. The data is then analyzed through two-way MANOVA technique. The findings of the research conclude that: (1) there were significant differences in learning activeness and learning achievement between groups which learned using ubiquitous learning strategies and electronic learning strategies; (2) there were significant differences in learning activeness and learning achievement between students when integrated with high self-regulated learning and low self-regulated learning; (3) there was an interaction between ubiquitous learning and electronic learning strategies integrated with self-regulated learning on learning activeness and learning achievement of students.

Keywords—Ubiquitous learning, electronic learning, self-regulated learning, learning activeness, learning achievement

1 Introduction

In recent years, information and communication technology that has been integrated into educational practices has produced a series of online learning trends, starting from electronic learning (e-Learning), continuing to mobile learning (m-Learning), and finally to ubiquitous learning (u-Learning). The practice of e-Learning and m-Learning has many positive impacts, but many negative impacts are also caused. Research shows that online learning can increase students' participation and productivity while helping them learn anytime and anywhere [1]–[4]. Other studies have found that online learning using mobile devices keeps students busy in downloading videos, watching movies, and listening music, while others spend hours of their time to playing games or chatting on social media. This leads to reduced students' performance, academic productivity, and learning achievements [5], [6].

The same problem is also found in Indonesia, in which mobile devices have become a tool that is closely related to the daily lives of learning practitioners such as lecturers and students. Hasella's research [7] revealed that students in Indonesia use mobile devices for more than 11 hours per day and mobile devices are used for browsing and are most often used to play online games and to access various existing social media (Instagram, Path, Facebook, Twitter). They tend to have mobile devices to keep up with current trends that demand them to be active in cyberspace or social media. During class time, they also often use gadgets to cover up the boredom because of long class hours. This causes that some of the materials explained by the teacher are no longer absorbed properly because students are not able to concentrate anymore with ongoing lessons, which can result in academic achievement, and students rarely discuss with their friends because it is more fun with his gadget.

A new effort is needed to maximize online learning strategies so that they can have positive and effective impacts on student academic productivity. Pedagogical factors have the greatest influence on the success, intention, and behavior of students to adopt online learning which includes the provision of more diverse content/teaching materials, strategies, and learning environments that can improve student learning performance [8], [9]. One of the principles of selecting and using learning strategies, teaching materials/media, and effective learning environments is to pay attention to students' individual differences. Students will learn in different ways and levels according to their needs, interests, or desires. Implementing methods that are appropriate to the needs, interests, and characteristics of students will be able to create a conducive learning atmosphere and increase student participation and learning achievement [10]. One of the innovative learning strategies that is in accordance with the principles of learning is ubiquitous learning (u-Learning). The purpose of u-Learning is to accommodate students and their learning styles by providing adequate information anytime and anywhere according to their needs and desires [11]. Ubiquitous learning integrates authentic learning environments, ubiquitous digital resources, functional objects, mobile devices, and wireless networks and enables learning on demand, based on students' personal needs, and their own activities [12], [13].

The concept of ubiquitous learning is strongly influenced by the flow of the psychology of humanism, cybernetism, and connectionism which has the characteristics of the learning process through two main approaches, namely:

- a) Through individual and independent exploration of various learning resources available in an unrestricted environment
- b) Through social interaction with various parties who have direct or indirect relevance to the knowledge learned [14]

Ubiquitous learning is a learning strategy that integrates mobile technology and enables learning to be done without limits, anywhere, anytime, and in any way (according to the context of learning) based on the characteristics, needs/desires of students [15]. Each learning activity consists of activities before class (online), face to face (offline/onsite), and activities after class (online). The principles of mobile ubiquitous learning are:

- a) Mobility
- b) Adaptability
- c) Accessibility
- d) Interactivity
- e) Interoperability
- f) Immediacy
- g) Permanency
- h) Pervasiveness
- i) Context awareness [16], [17].

The ubiquitous learning systems can be developed using online learning systems [18]. Lau [19] states that the effective ubiquitous learning environment can be created using various components of information and communication technology to support students in the learning process, namely:

- a) Flexibility in digital platforms
- b) Stimulation in a digital environment
- c) Flexible discussion platforms
- d) Student's confidence in digital communication
- e) Learning motivation and creativity

The ubiquitous learning system can be developed using Moodle platform; in which Moodle stands for "Modular Object-Oriented Dynamic Learning Environment" [20]. Moodle has become a term that is synonymous with software packages designed to help educators create quality online learning; in this case, Moodle is a Learning Management System/LMS [21]–[23].

In addition to the learning strategies factors, there are a number of factors that also affect the quality of learning. One of these factors is instructional conditions. Reigeluth [24] defines the instructional conditions as factors that influence the effects of methods and are therefore important for prescribing methods. Hence, conditions are variables that both (a) interact with methods to influence their relative

effectiveness and (b) cannot be manipulated in a given situation. Reigeluth & Merrill [25] grouped instructional conditions variables into three groups, namely:

- a) Objectives and characteristics of the field of study
- b) Constraints and characteristics of the field of study
- c) Characteristics of students. Student characteristics are aspects or qualities of individual students, such as talent, interest, motivation, goal orientation, self-regulated learning, intelligence, cognitive style, learning outcomes that have been held, etc.

One of the characteristics of students that is important to consider in ubiquitous learning is self-regulated learning. Self-regulated is the ability to control, organize, plan, direct, and monitor behavior to achieve a certain goal by using certain strategies and involves physical, cognitive, motivational, emotional, and social elements [26]. Some studies suggest that self-regulated learning is a predictor of learning achievement in learning environments such as technology-based learning/online learning [27], [28]. Student's self-regulated learning in an online environment may be more important than a face-to-face environment because an online environment requires a higher level of peer interaction and collaboration, which requires more proactive and self-regulation involved in students' personalities due to lack of support from teachers [29]. The ability of self-regulation in learning is needed by students to be able to organize and direct themselves and to be able to adjust and control themselves in completing learning tasks to improve learning achievement [30].

Based on the aforementioned explanation, it can be assumed that ubiquitous learning strategies and self-regulated learning will influence students' learning activeness and learning achievement. Learning activeness includes both physical and non-physical activities in the process of optimal learning and teaching activities so that it can create a conducive classroom atmosphere. Learning achievement is the achievement of learning objectives of the courses which are realized in the achievement of learning progress of each student in the form of learning achievement test scores. As a comparison of the effectiveness of the ubiquitous learning strategies, an electronic learning strategy (controlled) is used in which this strategy has long been used by several lecturers in managing subjects. Electronic learning is the use of electronic/internet technology to send, support, and improve teaching and learning.

1.1 Research problems

Referring to the background literature, the researcher focused on observation in exploring the learning activeness and learning achievement of students through ubiquitous learning in various self-regulated learnings. The followings are research problems formulated throughout this study:

- Examining the differences on the learning activeness and learning achievement of students using ubiquitous learning (u-Learning) and electronic learning (e-Learning) strategies.
- Examining the differences on the learning activeness and learning achievement of students who have high self-regulated learning (high SRL) and low self-regulated learning (low SRL).
- Analyzing the interaction between u-Learning and e-Learning strategies integrated with high SRL and low SRL focusing on the learning activeness and learning achievement.

2 Method

2.1 Research design

An experimental research method was used in this research to examine the main effect and interaction effect of independent variable and moderator variable on dependent variable. Quasi experimental pretest-posttest with nonequivalent control group design by Tuckman [31] was used. The independent variables were learning strategies, dependent variables were learning activeness and learning achievement, while moderator variable was self-regulated learning (SRL). The factorial planning of this research can be seen in Table 1.

Table 1. Experiment Factorial Design Pattern 2x2

Independent Variable		Learning Strategies			
		<i>u-Learning (X1)</i>		<i>e-Learning (X2)</i>	
Moderator Variable		<i>Learning Activeness (Y1)</i>	<i>Learning Achievement (Y2)</i>	<i>Learning Activeness (Y1)</i>	<i>Learning Achievement (Y2)</i>
Self-Regulated Learning (SRL)	High SRL (Z1)	Y1.Z1.X1	Y2.Z1.X1	Y1.Z1.X2	Y2.Z1.X2
	Low SRL (Z2)	Y1.Z2.X1	Y2.Z2.X1	Y1.Z2.X2	Y2.Z2.X2

2.2 Participants

The subjects of this research were students of the Department of Primary School Teacher Education of the Faculty of Education Universitas Pendidikan Ganesha Singaraja - Bali - Indonesia. They were 113 students divided into 4 classes (two classes were experimental classes, while the other two classes were control classes). Experimental classes consist of 60 students: 18 males and 42 females, while control classes consist of 53 students: 16 males and 37 females.

These students were all enrolled on Instructional Media course on their fourth semester. The two classes as experimental class and control class were determined using classes random sampling technique by assuming that all subject classes were homogeneous.

2.3 Instruments

The instrument of learning activeness was developed by referring to the indicator of learning activeness by Sardiman [32] which includes:

- a) Visual activities
- b) Oral activities
- c) Listening activities
- d) Writing activities
- e) Drawing activities
- f) Motor activities
- g) Mental activities
- h) Emotional activities

This instrument consists of 32 questions in the questionnaire compiled using a Likert scale. This instrument has been through expert validation and has been tested on students.

The learning achievement instrument used was an objective test type (multiple choice) with one correct answer and 55 questions. Score 1 was given when the answer was correct and score 0 when the answer was wrong. Total score was the score obtained divided by the maximum score multiplied by one hundred. The lowest score got a value of 0 while the highest score got a score of 100.

The instrument used to measure the students' SRL level was a closed questionnaire adapted from the Online Self-Regulated Learning Questionnaire (OSLQ) by Barnard [33], in which the questionnaire was prepared referring to the theory put forward by Zimmerman [34]. This OSLQ has been translated and re-validated by researchers. This OLSQ consisted of 24 items each item having the highest score of 5 and the lowest score of 1. This questionnaire was divided into 6 categories, namely:

- a) Goal setting
- b) Environment structuring
- c) Task strategies
- d) Time management
- e) Help seeking
- f) Self-evaluation

The results of the SRL questionnaire were in the form of scores which were finally divided into two parts, namely high SRL and low SRL.

2.4 Procedures

The researcher conducted a direct study on two classes appointed as experimental classes and two other classes as control classes. In the experimental classes, the researcher carried out learning activities using u-Learning strategies, whereas the control classes had their learning activities by using e-Learning strategies. The researcher identified the SRL of the two research subjects, both the control and

experimental classes. This was conducted to identify which students had high SRL or low SRL.

The researcher held the pretest and questionnaire of learning activeness for both research subjects at the same time. This was done in order to see how far the students mastered the materials which would be delivered by the researcher and to find out the level of students learning activeness before the experiment. Then, the researcher conducted the learning activities using u-Learning strategies for the experimental class and e-Learning strategies for control classes.

u-Learning strategies are taught as aligned with the course subject at that time, i.e. instructional media. Here, the role of the researcher was only as facilitator. The students were to search for their own knowledge as according to the guide and strategies of u-Learning. Learning took place over 10 learning activities over 10 weeks (including the provision of pretest and posttest). Learning activities consisted of activities before class (online), face to face/onsite (offline), and activities after class (online). Online activities that are not limited in space and time were done through online learning portals available on <https://u-learningclass.site> including:

- a) Accessing lecture material (books, files (doc, pdf, ppt, jpg, png, swf, exe), page, url, label
- b) Completing assignments (online text, file submission)
- c) Discussion (forum)
- d) Reading assessment (lesson/feedback)
- e) Presentation of material (web conference/BigBlueButtonBN)
- f) Dialogue between lecturers and students and between students (messages/chat)

All these resources and activities were used to apply the principles of the u-Learning strategies namely:

- a) Mobility
- b) Adaptability
- c) Accessibility
- d) Interactivity
- e) Interoperability
- f) Immediacy
- g) Permanency
- h) Pervasiveness
- i) Context awareness

Face-to-face activities in the classroom or onsite include the delivery of content with various methods (expository/lecture, question and answer, discussion, simulation) and learning approaches used by lecturers.

For control class, the learning activities were implemented using e-Learning strategies which could be accessed on <https://elearning.undiksha.ac.id>. Through this e-Learning system, students can obtain main course materials and enrichment materials, access assignments, and send answers to the lecturer. The materials and topics were the same in both classes, focusing on instructional media.

After all stages of learning have been carried out on the two learning strategies, the researcher manages a posttest and provided a learning activeness questionnaire at the end of the study to investigate the level of success of the strategies used in the study.

2.5 Data analysis

Data analysis technique is divided into two groups: data analysis for the test requirement analysis and data analysis to test the research hypothesis. Analysis was conducted for all research variables. For the test requirement analysis, data normality test and variance homogeneity test were carried out. Data normality test used Kolmogorov-Smirnov technique whereas variance homogeneity test used Levene's test. Data normality test and variance homogeneity test were used to fulfil all parametric assumptions.

The result of data normality test on learning activeness and learning achievement by using u-Learning and e-Learning strategies is presented in Table 2. Meanwhile, the result of data normality test on learning activeness and learning achievement by using high SRL and low SRL is presented in Table 3.

Table 2. Result of Data Normality Test on Learning Activeness and Learning Achievement based on the Learning Strategies

	Tests of Normality						
	Learning Strategies	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Learning Activeness	u-Learning	.107	60	.084	.968	60	.110
	e-Learning	.117	53	.066	.970	53	.193
Learning Achievement (Posttest)	u-Learning	.096	60	.200(*)	.964	60	.076
	e-Learning	.118	53	.062	.958	53	.057

* This is a lower bound of the true significance.
 a Lilliefors Significance Correction

Table 2 shows that the learning activeness scores in the experimental and control classes showed a significance value (probability) of 0.084 and 0.066 which was greater than 0.05. Likewise, with the learning achievement, the statistical test using SPSS show that the significance value (probability) was greater than 0.05, i.e., 0.200 for the experimental class and 0.062 for the control class. This means that both the final learning activeness score and learning achievement (posttest) in the experimental class and control class had a normal distribution.

Table 3. Result of Data Normality Test on Learning Activeness and Learning Achievement based on Students' SRL

		Tests of Normality					
		Kolmogorov-Smirnov(a)			Shapiro-Wilk		
	Self-Regulated Learning (SRL)	Statistic	df	Sig.	Statistic	df	Sig.
Learning Activeness	High SRL	.071	61	.200(*)	.966	61	.087
	Low SRL	.080	52	.200(*)	.974	52	.324
Learning Achievement (Posttest)	High SRL	.088	61	.200(*)	.968	61	.111
	Low SRL	.121	52	.054	.958	52	.064

* This is a lower bound of the true significance.
 a Lilliefors Significance Correction

Table 3 shows that the score of learning activeness in groups of students who had high SRL and students who had low SRL showed a significance value (probability) of 0.200 and 0.200 which was greater than 0.05. Likewise, the learning achievement score shows that the significance value (probability) was greater than 0.05, i.e., 0.200 for groups of students with high SRL and 0.054 for groups of students with low SRL. This means that both the learning activeness score and learning achievement (posttest) in the group of students with high SRL and low SRL had a normal distribution.

The result of homogeneity test on learning activeness and learning achievement is presented in Table 4.

Table 4. Result of Homogeneity Test on Learning Activeness and Learning Achievement

Levene's Test of Equality of Error Variances(a)				
	F	df1	df2	Sig.
Learning Activeness	1.712	3	109	.169
Learning Achievement (Posttest)	.573	3	109	.634

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
 a Design: Intercept+Learning Strategies+SRL+Learning Strategies * SRL

Based on the results of the Levene test in Table 4, the significance value for learning activeness data showed a significance value of 0.169, which was greater than alpha 0.05 ($p > 0.05$). Thus, it can be concluded that the variety or variance of learning activeness data was homogeneous. Likewise, learning achievement data had a significance value of 0.634 which was greater than alpha 0.05 ($p > 0.05$). It can be concluded that the learning achievement data variance was homogeneous. In this case, the variance-covariance matrix of the dependent variable that was the value of activity learning and learning achievements were the same for existing groups (independent variables), namely learning strategies (u-Learning and e-Learning) and SRL (high SRL and low SRL). Like ANOVA, the MANOVA output can be interpreted well if the variance-covariance matrix of the dependent variable is relatively the same in each independent group.

The analysis to test the research hypothesis, however, was conducted using MANOVA (Multivariate Analysis of Variance) statistic technique with the help of SPSS for Windows. All the parametric assumptions above were carried out at a significance level of 5%.

3 Result

3.1 Identification results of students' SRL on experimental and control classes

The identification result of students' SRL on experimental and control classes can be seen in Table 5.

Table 5. Results of Identification of SRL Students

Self-Regulated Learning (SRL)	Experimented Class	Controlled Class	Total
High SRL	33	28	61
Low SRL	27	25	52
Total	60	53	113

The result shows that within the experimental class, there were 33 students with high SRL and 27 students with low SRL. However, the control class consisted of 28 students with field high SRL and 25 students with low SRL. Therefore, it can be inferred that student with high SRL tended to be more dominant in both experimental and control classes.

3.2 Description of the result of early learning activeness and learning achievement pretest

The recapitulation of the results of early learning activeness and learning achievement pretest for student is presented in Table 6.

Table 6. Results of Early Learning Activeness and Learning Achievement Pretest

Self-Regulated Learning (SRL)	Experimented Class				Controlled Class			
	Learning Activeness		Learning Achievement		Learning Activeness		Learning Achievement	
	Average	Std. dev	Average	Std. dev	Average	Std. dev	Average	Std. dev
High SRL	65.48	4.47	53.64	5.98	66.25	4.25	51.71	8.73
Low SRL	66.70	3.81	52.70	8.45	65.92	4.02	53.96	5.68

Table 6 shows that the experimented class of students with high SRL obtained average of $M = 65.48$, $SD = 4.47$ in the early learning activeness score, whereas the pretest on learning achievement resulted in the average of $M = 53.64$, $SD = 5.98$. However, students with low SRL obtained average of $M = 66.70$, $SD = 3.81$ in the early learning activeness score, while the pretest on learning achievement obtained the average of $M = 52.70$, $SD = 8.45$. For the control group of students with high SRL, average of $M = 66.25$, $SD = 4.25$ was obtained in the early learning activeness; while the pretest score on learning achievement obtained average of $M = 51.71$, $SD = 8.73$. On the other hand, students with low SRL attained average of $M = 65.92$, $SD = 4,02$ for the early learning activeness score and the pretest score of learning achievement earned average of $M = 53.96$, $SD = 5.68$.

Perceiving the overall measurement results, there was no significant difference shown from the students' learning activeness and learning achievement between students who have high SRL and low SRL, both in the experimental and control classes. This provides an illustration that the research subjects' ability prior to the research is not significantly different.

The early learning activeness and learning achievement retrieved from the questionnaire and pretest result in Table 3 was then analyzed by using independent sample t test to obtain the significances of the early learning activeness and learning achievement before the implementation of u-Learning strategies and e-Learning strategies. The results of the different analysis on early learning activeness and learning achievement of students before being taught using u-Learning strategies and e-Learning strategies are presented in Table 7 and Table 8.

Table 7. Result of T Test of Early Learning Activeness and Learning Achievement Pretest

Group Statistics					
	<i>Learning Strategies</i>	<i>N</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error Mean</i>
Early Learning Activeness	u-Learning	60	66.03	4.198	.542
	e-Learning	53	66.09	4.110	.565
Learning Achievement Pretest	u-Learning	60	53.22	7.150	.923
	e-Learning	53	52.77	7.472	1.026

The SPSS output in Group Statistics as presented in Table 7 above shows that 60 students in the experimental class got an average score of early learning activeness of 66.03, while were 53 students in the control class got the average of 66.09. Meanwhile, the average score for learning achievement (pretest) in the experimental class was 53.22, while the control class was 52.77.

Table 8. Independent Sample Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		<i>F</i>	<i>Sig.</i>	<i>t</i>	<i>df</i>	<i>Sig. (2-tailed)</i>	<i>Mean Difference</i>	<i>Std. Error Difference</i>	<i>95% Confidence Interval of the Difference</i>	
									<i>Upper</i>	<i>Lower</i>
Early Learning Activeness	Equal variances assumed	.002	.961	-.078	111	.938	-.061	.784	-1.614	1.492
	Equal variances not assumed			-.078	109.81	.938	-.061	.783	-1.612	1.490
Learning Achievement (Pretest)	Equal variances assumed	.035	.852	.322	111	.748	.443	1.377	-2.285	3.171
	Equal variances not assumed			.321	107.91	.749	.443	1.380	-2.293	3.179

Table 8 shows the Sig Levene's Test score at 0.961 (early learning activeness) and 0.852 (learning achievement pretest). Both of these significance values are greater than 0.05 and it can be concluded that there was no difference in variance of early

learning activeness scores and learning achievement (pretest) between the experimental and control classes. Thus, testing can be carried out by independent t test with the assumption that there was homogeneous data (equal variance assumed). Results of the t-test for the early learning activeness score between the experimental class and the control class showed a significance value of $t(111) = -.078, p = 0.938$ ($p > 0.05$, accept H_0), meaning that there was no significant difference in the early learning activeness scores between the two classes. In addition, the results of the independent t-test for learning achievement scores (pretest) between the experimental class and the control class show a significance value of $t(111) = 0.322, p = 0.748$ ($p > 0.05$, accept H_0), meaning that there was no significant difference in learning achievement (pretest) between both classes. In other words, before the treatment of implementing u-Learning and e-Learning strategies, the learning activeness and learning achievement of students in experimental and control classes were not significantly different or relatively the same.

3.3 Description of the result of final learning activeness and learning achievement post test

The recapitulation of the results of final learning activeness and learning achievement posttest for student is presented in Table 9.

Table 9. Results of Final Learning Activeness and Learning Achievement Post Test

Self-Regulated Learning (SRL)	Experimented Class				Controlled Class			
	Learning Activeness		Learning Achievement		Learning Activeness		Learning Achievement	
	Average	Std. dev	Average	Std. dev	Average	Std. dev	Average	Std. dev
High SRL	91.67	3.198	89.00	3.152	83.50	2.769	81.11	2.986
Low SRL	85.15	3.739	82.15	2.878	82.54	2.827	78.84	3.484

Based on Table 9, it can be inferred that the experimental class of students with high SRL achieved the average score in the final learning activeness of $M = 91.67$, $SD = 3.198$, and the result of the posttest for learning achievement reached average of $M = 89.00$, $SD = 3.152$. Meanwhile, for students with low SRL, the final learning activeness reached average of $M = 85.15$, $SD = 3.739$ and the learning achievement posttest reached average of $M = 82.15$, $SD = 2.878$.

On the other hand, the average for control class was $M = 83.50$, $SD = 2.769$ in the final learning activeness through high SRL, whereas the post test result for learning achievement for student using high SRL reached average of $M = 81.11$, $SD = 2.986$. Meanwhile, for students with low SRL, the average score for final learning activeness reached $M = 82.54$, $SD = 2.827$ and the score for learning achievement posttest reached average of $M = 78.84$, $SD = 3.484$.

3.4 Description of the calculation results using MANOVA analysis technique

The calculation result of MANOVA analysis technique on the significant value of 0.05 is presented in Table 10.

Table 10. Multivariate Tests Analysis Result

Multivariate Tests(b)						
Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.999	58949.521(a)	2.000	108.000	.000
	Wilks' Lambda	.001	58949.521(a)	2.000	108.000	.000
	Hotelling's Trace	1091.658	58949.521(a)	2.000	108.000	.000
	Roy's Largest Root	1091.658	58949.521(a)	2.000	108.000	.000
Learning Strategies	Pillai's Trace	.535	62.214(a)	2.000	108.000	.000
	Wilks' Lambda	.465	62.214(a)	2.000	108.000	.000
	Hotelling's Trace	1.152	62.214(a)	2.000	108.000	.000
	Roy's Largest Root	1.152	62.214(a)	2.000	108.000	.000
SRL	Pillai's Trace	.402	36.256(a)	2.000	108.000	.000
	Wilks' Lambda	.598	36.256(a)	2.000	108.000	.000
	Hotelling's Trace	.671	36.256(a)	2.000	108.000	.000
	Roy's Largest Root	.671	36.256(a)	2.000	108.000	.000
Learning Strategies * SRL	Pillai's Trace	.204	13.875(a)	2.000	108.000	.000
	Wilks' Lambda	.796	13.875(a)	2.000	108.000	.000
	Hotelling's Trace	.257	13.875(a)	2.000	108.000	.000
	Roy's Largest Root	.257	13.875(a)	2.000	108.000	.000

a. Exact statistic

b. Design: Intercept+Learning Strategies+SRL+Learning Strategies * SRL

As seen in Table 10, it can be inferred that the learning strategies have significant value as tested by the procedures of Pillai's Trace, Wilks' Lambda, Hotelling's Trace, dan Roy's Largest Root. All procedures indicated a significant value of 0.000, which is smaller than the alpha 0.05 ($p < 0.05$). Hence, H_0 is rejected, and it can be derived that the learning activeness and posttest result of learning achievement showed differences on the two learning strategies. Based on the questionnaire and posttest scores, the learning activeness and learning achievement using u-Learning strategies proved to score higher than the learning activeness and learning achievement using e-Learning strategies.

Thus, the result of individual test on the independent and dependent variables (test of between-subject effect) using MANOVA is presented on Table 11.

Table 11. Result of Tests of Between-Subjects Effects

Tests of Between-Subjects Effects						
Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Learning Activeness	1535.614(a)	3	511.871	51.211	.000
	Learning Achievement	1737.687(b)	3	579.229	59.258	.000
Intercept	Learning Activeness	822191.024	1	822191.024	82256.779	.000
	Learning Achievement	766310.772	1	766310.772	78397.099	.000
Learning_ Strategies	Learning Activeness	796.562	1	796.562	79.693	.000
	Learning Achievement	877.027	1	877.027	89.724	.000
SRL	Learning Activeness	380.572	1	380.572	38.075	.000
	Learning Achievement	581.290	1	581.290	59.469	.000
Learning_ Strategies * SRL	Learning Activeness	223.823	1	223.823	22.393	.000
	Learning Achievement	146.934	1	146.934	15.032	.000
Error	Learning Activeness	1089.501	109	9.995		
	Learning Achievement	1065.446	109	9.775		
Total	Learning Activeness	840094.000	113			
	Learning Achievement	784251.000	113			
Corrected Total	Learning Activeness	2625.115	112			
	Learning Achievement	2803.133	112			

a R Squared = .585 (Adjusted R Squared = .574)

b R Squared = .620 (Adjusted R Squared = .609)

Based on the calculation result in Table 11, Test of Between-Subject Effects, it can be inferred that the learning activeness scored an F value of 79.693 with a significant level of 0.000 which is below alpha 0.05. Hence, H0 is rejected, meaning that there was a significant difference on the students’ learning activeness using u-Learning and e-Learning strategies. Furthermore, on the Test of Between-Subject Effects, it can be drawn that learning achievement scored an F value of 89.724 with a significant level of 0.000, which was below alpha 0.05. Hence, the H0 is also rejected, meaning that there was a significant difference in the learning achievement for students who had undergone the u-Learning and e-Learning strategies.

On the calculation result of Test of Between-Subject Effects above, it is noted that the learning activeness obtained an F value of 38.075 with the significant level of 0.000, which is below alpha 0.05. Thus, H0 is rejected, meaning that there was a significant difference on the learning activeness for students who had high SRL and low SRL. By analyzing the table, it can also be inferred that learning achievement test obtained an F value of 59.469 with the significance level of 0.000 which is below alpha 0.05. In another words, the H0 is rejected, meaning that there was a significant difference between the learning achievement of students who had high SRL and low SRL.

Based on the calculation result on Table 11 Test of Between-Subjects Effects, the learning activeness obtained an F value of 22.393 with the significance level of 0.000 which is below alpha 0.05. Hence, the H0 is rejected, meaning there was a significant interaction impact between the use of u-Learning and e-Learning strategies with the high SRL and low SRL on students’ learning activeness. In other words, students who were taught using u-Learning and e-Learning strategies integrated with high SRL and

low SRL acquired a quite different score in learning activeness. On another side, the result of Test of Between-Subject Effects show that learning achievement test scored an F value of 15.052 with the significance level of 0.000, which is below alpha 0.05. Therefore, H₀ is rejected, meaning that there was a significant impact in the interaction of u-Learning and e-Learning strategies with high SRL and low SRL on students' learning achievement. Thus, students who were taught using u-Learning and e-Learning strategies integrated with high SRL and low SRL had a far different learning achievement value.

In addition to comparisons on aspects of learning activeness and learning achievement, this study found other aspects that showed advantages and disadvantages of implementing u-Learning and e-Learning strategies. These aspects were flexibility, permanency, accessibility, immediacy, interactivity, and context awareness. Table 12 shows a comparison of the advantages and disadvantages of implementing the u-Learning and e-Learning strategies.

Table 12. The Advantages and Disadvantages of Implementing the u-Learning and e-Learning Strategies

Aspect	u-Learning	e-Learning
Flexibility	Students can learn on the right thing at the right place and time in the right way	Student learn at the right time
Permanency	Students can never lose their work	Students can lose their work
Accessibility	System can be accessed via ubiquitous computing technologies	System can be accessed via computer network
Immediacy	Students get information immediately	Students cannot get information immediately
Interactivity	Students' interaction with peers, teachers, and experts effectively through the interfaces of u-learning systems	Students' interaction is limited
Context Awareness	The system can understand the students' environment via database and sensing the learner's location, personal and environmental situations	The system cannot sense the students' environment

Based on Table 12, it can be concluded that the u-Learning strategies is better and provides advantages over the e-Learning strategies in various aspects. However, several problems were detected from the implementation of u-Learning strategies, namely:

- a) Internet access speed that is different in each region where students live may inhibit communication between lecturers and students and between students, especially in synchronous communication and web conference
- b) Differences in the level of sophistication of mobile devices owned by students, for students who have sophisticated devices they will enjoy learning resources and complete assignments better
- c) u-Learning is suitable for students who have high SRL because the characteristic of u-Learning is to give full autonomy to students to determine their own way of learning; whereas, for students with low SRL, they will experience difficulties.

4 Discussion

The results of the study show that there were significant differences in learning activeness and learning achievement for students who have undergone the u-Learning and e-Learning strategies. Learning activeness and learning achievement for students who have undergone the u-Learning were better than students who learnt by using e-Learning strategies. This is because ubiquitous learning system presented various learning methods such as individual learning, group work, fieldwork, and project-based learning. Likewise, there are various learning media or learning resources provided such as documents, presentations, animations, and multimedia that are tailored to student learning preferences. This will be able to provide creativity modeling to students, encourage students to be more active, and find ways of learning that are suitable for themselves. Using learning methods and resources in accordance with the material and characteristics of students will be able to create a conducive learning atmosphere and increase academic productivity [10].

The use of web conference, message, chat, and forum features is intended to create interaction between lecturers and students, as well as among students. One learning segment is organized by utilizing the BigBlueButtonBN feature. This feature is used to create online classrooms in real-time (web conference) in distance learning, lecturers and students can be anywhere. This feature has the following facilities:

- a) Slideshow presentation
- b) Live or streaming video
- c) VoIP
- d) Meeting recording
- e) Whiteboard
- f) Text chat
- g) Polls and surveys
- h) Screen sharing/desktop sharing/application sharing

Interaction that is mediated with computers online is important in education because it can provide benefits such as flexibility, efficiency in terms of cost and time [35]. Araújo's research results [36] found that social and collaborative interactions in the u-Learning environment can improve student performance, interactive features can enhance collaborative learning interactions and improve teaching/learning processes. The same research result was found by Asimwe & Khan [37] who revealed that ubiquitous computing and social interaction in learning can provide flexibility and encourage activity and productivity.

The use of lesson features enables lecturers to deliver content and/or practice activities in an interesting, flexible, and adaptive way (adjusting to student achievement). Lecturers create a linear set of content pages or learning activities that offer various paths or options for students. In this case, the lecturer can know or ensure students' understanding by giving various statements/questions. In this u-Learning system, students are given true-false statements. Student answer choices will determine the next activity, students who answer correctly can advance to the next

page / problem, while students who answer incorrectly are taken back to the previous page / enrichment material or diverted to the path or discussion page. Thus, students can learn according to their speed so that learning outcomes can be achieved optimally.

Moreover, this u-Learning system has another advantage in improving learning achievement, i.e., the direct feedback given by the lecturer to students' assignments. This feedback is in the form of positive and negative reinforcement from lecturers. Feedback given in the assessment allows students to measure their progress, consider alternative learning strategies, and project their own continuous learning needs [38]. Diverse assessment methods and the right of student access to their grades will encourage students to continue to study hard in order to improve their learning outcomes and excel in class.

The research results show that there were significant differences in learning activeness and learning achievement for students based on students' SRL. Learning activeness and learning achievement for students who had high SRL were better than students who have low SRL. Students who had high SRL had high learning activeness. This is because students are active and constructive in setting their learning goals and then trying to monitor, regulate and control their cognition, motivation, and behavior to suit their goals and contextual conditions. Students who have a high SRL are those who can manage their planning strategies and use study time better which can increase their activity and make them learn better [39]. The research results of Wan, Wan, Compeau & Haggerty [40] showed that SRL students were positively related to the development of their activities and learning skills. Students who have a high SRL will be better at:

- a) Reflecting on their learning activities
- b) Finding aspects of strengths and weaknesses in their learning activities
- c) Setting goals and plans for developing their learning
- d) Finding ways and adapting their learning activities and all of these things are a form of active learning

Paris, S.G., Winograd [41] concluded that students who can organize themselves in their learning process will get high academic achievements. Students who have high self-regulated learning, will have a high level of motivation and metacognitive as well. Someone with high metacognition, then will be able to plan well, regulate themselves well, organize and evaluate themselves in the learning process [42].

Moreover, the results show there was a significant impact in the interaction of u-Learning and e-Learning strategies with high SRL and low SRL on students' learning activeness and learning achievement. Interaction can occur if the independent variable and the moderating variable match. Interactions can also occur when more than one independent variable has a significant effect. The interaction between these two variables shows that the learning strategy and SRL variables are suitability in increasing learning activeness and learning achievement. u-Learning will be suitable for students who have high SRL, but it is not suitable for students who have low SRL. This can occur because the characteristics of the u-Learning learning strategy are learning that integrates mobile technology that enables learning to be done

seamlessly, anywhere, anytime, and in any way (according to the learning context) based on characteristics, needs/student desires. This will require high SRL to be able to find ways of learning and learning resources that best suit their needs/desires. How to study and learning resources in accordance with the wishes of students will be able to realize a high learning activity. In online learning, research conducted by Kramarski & Gutman [43] states that SRL is very efficient in improving learning achievement. Even according to Zumbrunn [44] states that SRL is very important to improve academic achievement and learning motivation. In this process, students can independently plan, monitor and access their learning online and evaluate themselves when the learning is complete.

5 Conclusion

This research aims to examine the effect of ubiquitous learning strategies and self-regulated learning on learning activeness and learning achievement of student in higher education. The research found that u-Learning strategies used has significantly affected the scores of students on both learning activeness and learning achievement. The research also discovered that there was a significant difference in the learning activeness and learning achievement between students who had high SRL and those of low SRL. Moreover, the research also identified an interaction between u-Learning strategies and e-Learning strategies with high SRL and low SRL on the learning activeness and learning achievement of students. Thus, the u-Learning strategies has advantages over the e-Learning strategies in achieving/increasing learning activeness and learning achievement depending on students' SRL. In managing learning, lecturers are advised to use learning strategies that are more oriented to the characteristics of students, especially SRL student.

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7 Authors

I Kadek Suartama is with Universitas Pendidikan Ganesha in Indonesia.

Punaji Setyosari is with Universitas Negeri Malang in Indonesia.

Sulthoni is with Universitas Negeri Malang, Malang, Indonesia.

Saida Ulfa is with Universitas Negeri Malang in Indonesia.

Muhammad Yunus is with Universitas Syiah Kuala, Banda Aceh, Indonesia.

Komang Anik Sugiani is with Politeknik Ganesha Guru in Indonesia.

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