A Comparison Study of Student's Achievement Using Assignment Log

Kanyuma Kamata, Wuttiporn Suamuang, and Surachai Suksakulchai

***Abstract*—College students can engage in a variety of activities that benefit their lives and studies. While time management and allocation may appear to be extremely important to post-secondary students, it is also associated with a wide range of difficult skills that require students to manage time in order to complete tasks. This research presented an experiment to compare an effectiveness of assignment logs based on students' learning achievement. The participants included 68 undergraduate students who were a part of an electronic engineering program at a large technical university in Bangkok. The results using Analysis of Variance and Tukey post hoc test presented that student who learned with assignment logs had higher learning achievement ($p < 0.001$) and time management ($p < 0.05$) than those who learned without assignment logs. In assignment logs, assignment scores were a statistically significant effect on learning achievement ($p < 0.01$) and assignment logs improved students' assignment scores and learning achievement ($p < 0.01$).**

***Index Terms*—Assignment completion/ Assignment logs/ Learning environment.**

I. Introduction

College students can engage in a variety of activities that benefit their lives and studies [1]. Activities can be included both co-curricular and extra-curricular interests [2], [3], and it is possible to boost students' creative abilities and achievements [4]. While time management and allocation may appear to be extremely important to post-secondary students, it is also associated with a wide range of difficult skills that require students to manage time in order to complete tasks [5]. According to Dembo, Nicklin [6], undergraduate students still to fail to finish or submit assignments on time. Because of poor time management, one-fourth of first-year engineering students completed less than 80% of their homework [5]. Furthermore, many students were unsure about how to manage their time [7]. There are some problem behaviors of doing homework assignments [8], for example, some students were unable to finish homework assignments on their own and prefer to copy assignments from their classmates [9]. As a result, failure to complete assignments is one of the issues in higher education, which is caused by poor time management and leads to inferior learning achievement [6].

Ref. [10] defined assignments as "any academic, course-related task assigned by the instructor intended for students to carry out during non-class hours". [11] mentioned homework as "tasks assigned to students by schoolteachers that are meant to be carried out during non-school hours". Regrading Thai literature, [12] defined assignments as an example of problems or instructions set up in those students can practice those assignments. In the present study, homework assignments refer to homework or coursework assigned by instructors either inside or outside the classroom and these assignments may use to evaluate students' outcomes as part of the final course grade.

Homework assignments are an important part of students' learning at all levels of education. It is intended to help students improve their knowledge and skills [13], [14] Furthermore, it improves student retention and minimizes failure rates [15]. As a result, Homework assignments enhance students' performance in a variety of ways, and another goal of Homework assignments is to assess students' learning (Vatterott, 2018). Homework is frequently used by instructors as a means of commenting on and determining students' progress. Furthermore, students express a greater desire for assessment in the form of assignments or a combination of exams and assignments [16]. However, together with class participation and test results, assignments are considered in the total grade computation [17].

Assignment logs, a journal for recording the data relating to assignments, are another technique for monitoring and tracking students' assignment behaviors, according to the literature [18]. It can help increase students' awareness and critical thinking about learning [19]. According to [18], homework logs assist students in completing more tasks and achieving learning achievement. Instructors should urge students to keep a homework log to track their progress and provide feedback on the elements that affect their learning achievement [18]. Nonetheless, Whalen [20] discovered that learning logs boosted students' attention, diligence, and management but not their understanding of the content. Therefore, the focus of this study will be on assignment logs on students' learning achievement.

II. Research Questions

1) How does the experiment group (with assignment logs) affect learning achievement, compared with the control group (without assignment logs)?
2) How does assignment log scores affect learning achievement and assignment scores?
3) How does assignment scores affect learning achievement when comparing two group?

III. Research Methodology

The main purposes of this study were to explore and students' learning achievement with and without assignment

Manuscript received April 19, 2022; revised July 5, 2022.

The authors are with King Mongkut's University of Technology Thonburi, Thailand (e-mail: kanyuma.j@mail.kmutt.ac.th, wuttiporn.sua@kmutt.ac.th, surachai@kmutt.ac.th).

doi: 10.18178/ijiet.2022.12.12.1770

logs.

A. Participants

There were 68 undergraduate students participating in this study. The participates were divided into two groups: 39 undergraduate students of Embedded System Course and 26 undergraduate students of Digital Circuit Design Course. Purposive sampling was used in this study, and they contribute information and participate in the experiment voluntarily [21].

B. Design Instruments Used in Experiment

The experiment was occurred into two classes. Class A is Digital Circuit Design, in which the content involves theory totally. Class B is Embedded System in which the content integrates theory and practice. Each class was taught by two sessions; For the first nine weeks, two sessions of each class were assigned to teach through the traditional method. Students who participated in class A were taught by lecture-based learning, and those who took part in class B were taught by a flipped classroom. After midterm examinations (week 10-18), Assignment Log, see Fig. 1, was applied in two classes for nine weeks. Tables I, II present the detail of unit plans used in the class.

TABLE I: THE DETAIL OF UNIT PLANS IN DIGITAL CIRCUIT DESIGN

Week	Content	Teaching method
1	Number Systems and Conversion	Lecture-based learning Without assignment logs
2	Binary Arithmetic	
3,4	Boolean Algebra	
5,6	Karnaugh Maps	
7,8	Quine-McCluskey Method	
9	Midterm examination	
10	Multi-level Gate Circuits	Lecture-based learning with assignment logs
11	Multiplexers, Decoders, & Programmable Logic Devices	
12	Flip-Flop	
13	Counters	
14	Counters for Other Sequences	
15-16	Moore Machine Design	
17	Mealy Machine Design	
18	Final examination	

TABLE II: THE DETAIL OF UNIT PLANS IN EMBEDDED SYSTEM

Week	Content	Teaching method
1	Introduction to Arduino IDE & NodeMCU	Flipped classroom without assignment logs
2	Basic Programming with NodeMCU, e.g., of Built-in LED Blinking	
3	Application with digital output, e.g, Multiple external LED blinking	
4	Application with digital input e.g., Push button control, etc.	
5,6	Introduction to Blynk	
7,8	Controlling motor via Blynk application	
9	Midterm examination	
10	Application with analog outputs in NodeMCU	Flipped classroom with assignment logs
11,12	Application of reflector sensors for line tracking applications	
13,14	Using and programing Ultrasonic sensor	
15,16	Application of a servo motor for pushing a ball	
17	Final Project	
18	Final examination	

The lecture-based learning involves only inside class learning lasting two hours for lecture and one hour for activities. Students worked on activities individually and collaboratively. For the Flipped classroom, the lecture spent two hours and activities as homework used one hour of out of class learning. Students took out of class learning via the ThaiMOOC system, thaimooc.org. In class, the lecture took one hour to review the content and was followed by a two-hours small project, in which students worked on pairs and individuals. Both classes were assigned homework weekly. Students would submit the homework though a Facebook group by due dates.

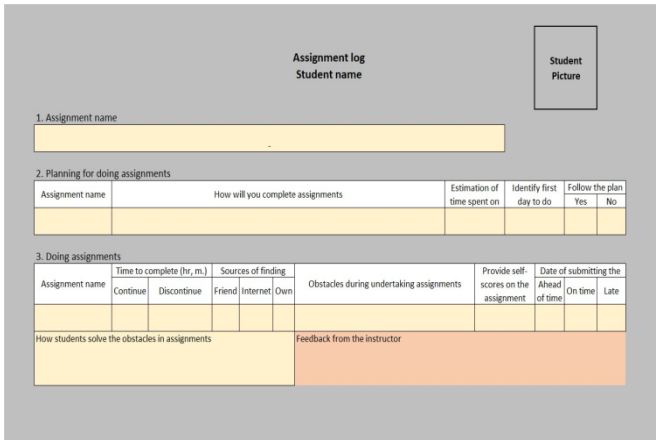

Fig. 1. The assignment logs that were used.

C. Instruments and Data Collection

The pre- and post-tests were used for evaluating learning achievement. There were two different test-sets: one for the embedded system course, another one for the digital circuit design course. Each course had 25 items of pre- test, which items were similar content of 25 post-test items (50 total items with five choices). All items were verified content validity to "represent the concept being measured in every dimension" [22]. Content validity was estimated using Index of item-objective congruence (IOC) conducted by three experts. The expert valued 1 of agree, 0 of not sure and -1 of disagree. The average IOC value of each item should be above 0.49 for being an appropriate item in the test. The congruence between each item and course objectives in this study indicated good content validity, which the values ranged from 0.67 to 1.00 for the embedded system course, and from 0.33 to 1.00 for the digital circuit design course. However, the items, which were below 0.5 were corrected or removed. Besides, in order to be a good test, the research further assessed difficulty, discrimination of each item.

Students answered pre-test in week 1 and 9 and post-test in week 8 and 18. They performed the test by paper and pencils and spent two hours to complete it.

Secondly, assignments included coursework assigned in class and out of class by the instructor. Assignment scores were employed to represent assignment completion. Assignment scores were counted from testing scores, quality and the number of assignments completed, and time of assignments submitted. However, the differences in assignments' assessment of both classes were existent from types of assignments. For example, class B used small project as assignment scores, while class A used problem-solving assignments as assignment scores. The total of assignment scores were 40 points.

The third instrument for this section was assignment logs. Assignment logs are a schedule for students to fill the information relating to their plan for doing assignments. The assignment log form used in the study was applied from Bembenutty and White [18], Zimmerman, Bonner [23]. It relates to assignment name, estimation of time spent, time spent, and source of finding assistance to complete an assignment, obstacles during undertaking assignments and how students solve the problems and self-evaluation for satisfaction in assignment completion. The five experts who are proficient in the educational technology curriculum and pedagogy, Educational Research and Evaluation evaluated and proved using assignment logs. The experts considered that in overall, the learning framework was in agreement, which scores were at 4.60. Measures of assignment logs involve the quality of assignment logs, and time to submit assignment logs and were conducted by the instructor. Students were informed that they had to report their assignment logs weekly for eight weeks through their google document, and assignment log scores were not counted for their grades.

The satisfaction survey on using the assignment logs was the last instrument developed by the instructor and researcher. They followed [24] to establish multiple items to represent every dimension. After that, the survey was validated by three experts using Index of item-objective congruence (IOC). The consistent results revealed appropriated items, which scores ranged from 0.67 to 1.00. Some of items were corrected to be clearer due to the experts' suggestion. Finally, the survey involved 18 items from six aspects: content knowledge, assignment logs, assignments, instructor, and an overall view. Both surveys, students spent ten to fifteen minutes to complete it via an online survey and were informed that the survey was anonymous. The scores would not affect any students' grades.

D. Data Analysis

In this section, data was analyzed using Analysis of Variance (ANOVA) to assess differences in learning achievement across the four teaching techniques [22]. T-Test statistics were used to compare learning achievement between two groups of assignment scores and assignment log scores. Additionally, descriptive statistics were used to analyze satisfaction on the assignment logs and assumptions.

IV. Results

A. The Results Relate to Learning Achievement

To determine how the Assignment logs affects learning achievement, compared with Lecture-based learning method, and Flipped classroom. One-way analysis of variance (ANOVA) was employed with teaching methods (including Assignment logs, lecture-base and flipped classroom learning) as independent variables and learning achievement as a dependent variable. Table III presents mean and standard deviation of each teaching method on learning achievement.

Assumptions indicated no concerns with normality, but Homogeneity of Variance assumptions could not be assumed for the flipped classroom method. However, four missing values in Class B were found and then were removed. ANOVA revealed that the effect of learning achievement differed by teaching method (lecture-based learning, flipped classroom and Assignment logs), $F(3, 126) = 13.27, p < 0.001$, representing large effect size of variance. Table IV. demonstrates the effect of the teaching methods on learning achievement. To test teaching method differences, Tukey post hoc test presented the results as follows; students who learned with assignment logs in both class A, and B had higher learning achievement than those who learned without assignment logs ($p < 0.001$). There was a significant difference of learning achievement between assignment logs of class B and Flipped classroom ($p < 0.05$). Additionally, no significant difference in learning achievement was found between assignment logs class A, and B ($p = 0.960$).

TABLE III: Descriptive Data for Learning Achievement on the Teaching Methods

	Method	n	Gain scores (Mean)	SD
Class A: lecture-based learning	Without assignment logs	26	-.31	4.00
	With assignment logs	26	5.19	3.93
Class B: Flipped classroom	Without assignment logs	39	3.23	3.12
	With assignment logs	39	5.69	4.78

TABLE IV: ANOVA Results — Differences of Learning Achievement on the Teaching Methods

Variance	SS	df	MS	F-ratio
Between Groups	638.62	3	212.87	13.27***
Within Groups	2020.81	126	16.04	
Total	2,659.42	129		

Note: *** $p < 0.001$

Therefore, pertaining to the finding earlier, assignment logs had an effectiveness for applying in learning for higher education.

B. The Results Relate to Assignment Completion

The finding indicated that assignment scores impacting learning achievement were significant statistically, relating to assignment logs class A ($p < 0.01$), B ($p < 0.01$), and overall ($p < 0.001$). Students who received higher assignment scores had more significant learning achievement than those who received lower assignment scores. In summary, when

students learnt with assignment logs, assignment scores or completion can develop learning achievement.

TABLE V: DESCRIPTIVE DATA AND T-TEST RESULTS OF ASSIGNMENT SCORE ON LEARNING ACHIEVEMENT

Assignment scores	n	Mean	SD	df	t-test
Assignment logs class A					
Higher scores	13	7.32	2.76	24	-3.13**
Lower scores	13	3.20	3.87		
Assignment logs class B					
Higher scores	17	8.47	4.08	37	-3.69**
Lower scores	22	3.55	4.21		
In overall					
Higher scores	30	7.97	3.65	63	-4.80***
Lower scores	35	3.42	3.95		

Note (s): ** $p < 0.01$, *** $p < 0.001$

To verify the usefulness of the assignment logs, how assignment logs affect learning achievement and assignment scores were performed. Table V, VI. shows descriptive data and t-test results of assignment log scores on learning achievement and assignment scores. The finding indicated that assignment logs significantly affected learning achievement and assignment scores. Students who did assignment logs had significantly greater learning achievement and assignment scores than those who did not assignment logs, $p < 0.01$.

TABLE VI: DESCRIPTIVE DATA AND T-TEST RESULTS OF ASSIGNMENT LOG SCORES ON LEARNING ACHIEVEMENT AND ASSIGNMENT SCORES

Assignment logs	n	Mean	SD	df	t-test
Learning achievement					
Students who did not do assignment logs	33	3.71	4.22	63	-3.66**
Students who did assignment logs	32	7.39	3.86		
Assignment scores					
Students who did not do assignment logs	33	32.84	8.21	63	-2.76**
Students who did assignment logs	32	38.52	8.36		

Note: ** $p < 0.01$

There were 64 completed surveys from 64 surveys because these data were gathered via an online survey (office forms) and students can refuse to provide the answers without any effect on their study and were reminded anonymous for the survey. Table VII lists students' satisfaction using the assignment logs. Students had the most satisfaction on using the assignment logs in terms of the instructor, followed the assignments. The lowest satisfaction was assignment logs.

TABLE VII: STUDENTS' SATISFACTION ON LEARNING USING ASSIGNMENT LOGS

List of the satisfaction	n	Mean	SD	Satisfaction level
In overall	64	4.13	0.79	High
Instructor	64	4.02	0.79	High
Assignments	64	3.89	0.72	High
Content knowledge	64	3.86	0.75	High
In overall	64	4.13	0.79	High
Instructor	64	4.02	0.79	High
Assignments	64	3.89	0.72	High
Assignment logs	64	3.73	0.77	High

V. DISCUSSION

College students can engage in a variety of activities that benefit their lives and studies. While time management and allocation may appear to be extremely important to post-secondary students, it is also associated with a wide range of difficult skills that require students to manage time in order to complete tasks. Therefore, assignment log is an important tool that can help students to manage their time, resulting to gain higher academic achievement and completed tasks. The main purposes of this study were to explore and students' learning achievement with and without assignment logs.

In the current results, students who received higher assignment scores had greater learning achievement than those who received lower assignment scores. This result adheres to Planchard, Daniel's study [10]. Students who completed more amount of homework tend to gain higher exam scores [10]. Assignments help students to insight the value of learning, realize in their flaw in an otherwise learning and more understand content knowledge which in tune to a higher grade [25].

To gain new deep knowledge about the Assignment logs, assignment logs for improving students' achievement and assignments scores was examined. This finding revealed that students who did complete assignment logs had significant greater learning achievement and assignment scores than those who did not complete assignment logs. This result is in line with Bembenutty and White [18]. They claimed that the homework log is another tool for monitoring and tracking students' assignment practices. It helps students to complete assignments more and success in their academic. Instructors should encourage students to use a homework log for recording data related to homework completion, and to provide students feedback about the factors that intervene students' academic performance [18]. However, A study by Gramling [26] showed that using academic planners in high schools did not support timely homework completion and may not be a motivating factor for homework completion.

The result relied on the satisfaction survey in dimensions of the instructor, assignments, content knowledge, assignment logs, and overall view. The results showed that the overall view was the highest satisfaction, followed by the instructor aspects. These results may be implied that students like to learn in the subjects that may be useful for students in overall aspects. However, assignment logs had the lowest scores of satisfactions. This result may be interpreted that students have to take more time to do assignment logs that is aside from spending time on assignments. Nonetheless, [27] designed the learning logs on the web site and its interface contained the user-friendly and it is easy to enter the data. Moreover, Kurt (2007) provided guidelines on how to use online learning logs to students. The next study that will apply assignments logs may consider convenience to use the

assignment logs in that it can save students' time.

VI. Conclusion

This research presented an experiment to compare an effectiveness of assignment logs based on students' learning achievement. The results demonstrated that students who learned with assignment logs had higher learning achievement and time management than those who learned without assignment logs. In assignment logs, assignment scores were a statistically significant effect on learning achievement and assignment logs improved students' assignment scores and learning achievement. Therefore, educators and instructor may apply the assignment log to for monitor and track students' assignment practices, resulting to students' achievement.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Kanyuma Kamata was responsible for designing research methodologies, experiments, and pre- and post-tests for data collecting. Wuttiporn Suamuang was in charge of developing the questionnaire as well as the assignment log. Surachai Suksakulchai was in charge of refining the study technique, reviewing the research's direction, and authorizing the final version of the paper.

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Kanyuma Kamata is a lecturer at Electrical Technology Education Department, Faculty of Industrial Education and Technology, King Mongkut's University of Technology Thonburi, Thailand. Her research relates to teaching and learning in the area of electronic, electrical, and robotics.

Wuttiporn Suamuang is an instructor at Electrical Technology Education Department, Faculty of Industrial Education and Technology, King Mongkut's University of Technology Thonburi, Thailand. Her research relates to teaching and learning in the area of computers. She got her a scholarship for her Ph.D. in 2016.

Surachai Suksakulchai is an associate professor at the Electrical Technology Education Department, Faculty of Industrial Education and Technology, King Mongkut's University of Technology Thonburi, Thailand. He received his bachelor's degree in Electrical Technology Education in 1985 and Electrical Engineering in 1987 from King Mongkut's University of Technology Thonburi, Thailand. He also received master's and doctoral degrees in electrical engineering at Vanderbilt University, USA. His current research includes robotics, electrical education, and robot-based education.