Comparison Study of Student's Learning Achievement between the Flip Classroom with and without Group Management

Kanyuma Jitjumnong and Surachai Suksakulchai

***Abstract*—Lecturers in universities normally use lectures as a primary teaching method. This teaching style has one drawback; it cannot respond to individual differences. A flipped classroom, on other hand, is an instructional strategy that allows students with different learning styles to learn together. It gives students a chance to study class materials, e.g., online lessons, videos and other appropriate media, as their suitable times and places in advance before the class. Then the students come in the class to do activities provided by lecturers to practice higher skills. However, in this method, students must take more responsibility for themselves, both in and outside the classroom, and therefore some students may not be able to complete the in-class activities on time. Therefore, in this research, a group management technique was applied with the flipped classroom method. The technique was divided students into a small group of 3 people in which students with the highest GPA in the class acting as tutors and mentors for the groups they belong to. The objective of this research was to compare the learning achievements between the flipped classrooms with and without group management applied. The sample group used in this research was 24 second-year undergraduate students in the Department of Electrical Education, Faculty of Industrial Education and Technology, King Mongkut's University of Technology Thonburi who enrolled in ECE 101 Digital Circuit Design class in the academic year 2018. The comparison result showed that the learning achievements of the students in the flipped classroom with the group management ($\bar{x}$ = 12.46, SD = 1.69) was higher than the normal flipped classroom ($\bar{x}$ = 8.83, SD = 2.60) with statistically significance at 0.01 levels.**

***Index Terms*—Flipped classroom, group management, social strategy, satisfaction, learning achievement**

I. Introduction

Lecturers in universities normally use a lecture-based technique, as a primary teaching method to describe various principles of subjects and this method has several advantages. For examples, a lecturer can provide a lot of content to students in a short period of time compared to other methods, and it can be used to introduce various content before starting practices or other activities also.

However, despite all these advantages, this teaching method has failed to motivate and draw attention to students [1], and the most considered disadvantage is that it cannot respond to individual differences [2]. From [1], this method is suitable for only students with higher grades compared to students with lower grades. This is because students, with different aptitudes and competency, have to study along with others in the same room to learn the same content in a limited time. As a result, some students can understand the content very well, while other students may not understand it at all. Therefore, to teach the whole class to understand the same thing in such a limited time is so difficult [3]. Especially, in Thailand and Asia [4], for example, most students are very shy or withdrawn, and hard to find ones to raise their hands for answering lecturers' questions. To respond to students' differences, material content can be provided by letting students preparing themselves [5]-[7], e.g., studying content through online lessons, video, pre-recorded lecture, other necessary activities [8], etc., in advance before the class. This technique can reduce time students spent for long lectures in the classroom [3]. Instead, in the class, lecturers can develop students at advanced levels through various activities in the classroom. This method of teaching is called a flipped classroom [2], [3], [9].

However, studying in this technique, students must take more responsibility for themselves. While doing a class activity, there may be some students who cannot complete the class assignment or activities on time. Therefore, students often have to request some help from their lecturers or just to ask their classmate sitting next to them even no right answers returned. In many times, there are many students ask for help from the lecturer at the same time, and therefore it can lead to a long waiting line for the students to get help. While they are waiting, they may be doing other non-academic activities such as talking, playing with their phones, and etc. For Southeast Asian students, e.g., Thai students, there also is another issue; there are a lot of shy students in this region. Shy students are always uncomfortable to participate any class activities; they do not ask or answer any questions. Therefore, it is very hard to apply a teaching method involving student activities in classrooms. As a result, it takes a lot of time in each activity and cannot be as successful as it should be [10]. Therefore, in this research, the author was interested in expanding classroom management techniques in [11], [12] to a flipped classroom by using the principle of peer-to-peer learning [13] and comparing with a normal flipped classroom instruction to find a technique that can be used to promote classroom activities which, in turn, may help to increase students' learning achievement and satisfaction.

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II. Objective

The objectives of this paper were:

1) To study the effect of using social strategies as a classroom management tool to increase the classroom productivity
2) To compare students' learning improvement between the flipped classroom with and without group management
3) To compare students' satisfaction between the flipped classroom with and without group management

III. Research Methodology

The purpose of this research is to compare the learning achievement of the flipped classroom with and without a group management technique. In this research, the sampling groups are divided into two groups: an experimental group and a control group. The sample group used in this research is 24 second year undergraduate students in the Department of Electrical Education in Faculty of Industrial Education and Technology, King Mongkut's University of Technology Thonburi who enrolled in ECE 101: Digital Circuit Design class in the academic year 2018. The research objective is to compare the learning achievement of the students in the flipped classroom with group management, FC/G [11], [13], and without the group management, FC [2], [3], [14]. The students in both groups are divided into sub-groups of three students. The students in the control group can manage their own group members according to their needs and they can also choose where to work in the class [13]. Whereas the students in the experimental group, members of a group and their work stations were assigned by the lecturer. Moreover, each of the highest GPA students of the class, eight students in total, was assigned to each group to act as a group's mentor, like a teacher assistant (TA), to help their group members when needed. The student mentor was then assigned to sit in the middle of the group, see Fig.1, to make it easier for giving advice to the members. Fig.1 also shows the location of each group in the class. Note that an electronic lab was used as a teaching class.

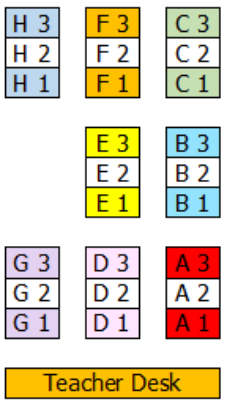

Fig. 1. Desk arrangement with mentors sitting in the middle of each group, A2, B2, …., H2.

In the experimental process, students in the control and experimental groups are assigned to study the class content through instructional materials, e.g. pre-recorded video presentations posted online, books, etc., one week in advance. In the classroom, after the class starts, both control and experimental groups receive a short quick quiz using Kahoot, an online quizzing tool, about their study assignments. Using Kahoot in the class has a positive effect on students' learning [15], if there is no the Internet access, QR code cards may be used instead [16]. Kahoot is a game that is engaging and inspiring for students to enjoy [17], [18] and increase students' motivations [19], [20].

The Kahoot-based quiz is just a tool to give students motivation for studying the assignments at home and the scores gathered are not used in the grading but can be used to stimulate students to enjoy the quiz. After that, both control and experimental groups were given with three assignments, starting from a simple question to a difficult one. Students had to work together in thinking and finding answers as quickly as possible. For the experimental group, students who act as mentors are not allowed to solve the problems directly. However, she/he could only give counsel to group members who struggle in solving the problems.

Before and after the experiments, both groups took pre- and post-test examinations respectively. Those experiments took 3 weeks each. After each section, students were asked to rate their satisfaction of each experiment using questionnaire surveys, which is divided in three dimensions, facilitator, learning activities, and knowledge sharing as shown in Table I.

TABLE I: Techniques Used of Each Aspect in Both Sections

Dimensions	**FC**	**FC/G**
Facilitator	Lecturer	Lecturer & student mentors
Learning activities	Only in the class	Both inside and outside the class managed by the group mentors
Knowledge sharing	Group discussion	Facilitated by student mentors in group discussion

The results are presented in the next section.

IV. The Results

The results of the research were divided into two parts, students' learning achievements and satisfaction. In the first part, both student groups had taken pre-test exams before the experiment and the result shown in the Table II, the comparison results of the pre-test scores of both groups using the t-test. The computational result showed that the average scores of the control group ($\bar{x}$ = 4.83, SD = 1.58) and the experimental group ($\bar{x}$ = 4.25, SD = 1.78) had no difference statistically in knowledge before entering the experiment. Therefore, the sample groups are suitable for the experiment.

Note: *The experimental group had lower average scores than the control group.*

After the experiment, students of both groups were given a posttest exam and the result was shown in Table III, the comparison results of post-test scores of both groups using t-test. From the comparison result, it was found that the test scores of the FC/G ($\bar{x}$ = 12.46, SD = 1.69) is higher than the FC ($\bar{x}$ = 8.83, SD = 2.60) with statistically significance at 0.01 levels.

TABLE II: COMPARISON OF PRE-TEST SCORES OF BOTH GROUPS (FLIP CLASSROOM WITH AND WITHOUT GROUP MANAGEMENT) USING T-TEST INDEPENDENT STATISTIC TO FIND DIFFERENCES BETWEEN THE GROUPS

Type of teaching	N	$\bar{X}$	S.D.	t-test	Sig.
FC	24	4.83	1.58	1.091	.287
FC/G	24	4.25	1.78		

**p<0.05

Fig. 2 showed the comparison of number of students in each score range, below 25%, 25-49%, 50-75% and above 75%, between the flipped classroom with and without group management. From the Fig. 2, it was found that the number of students with scores above 75% were increased from 8% to 75% and the number of students with scores below 25% were decreased from 29% to 0%.

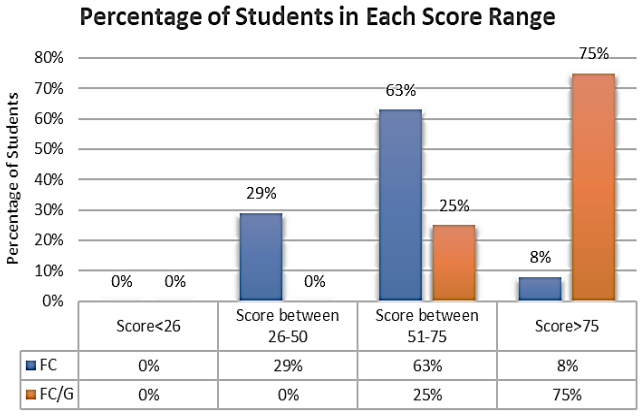

Fig. 2. Comparison of number of students in each score range between the flipped classroom with and without group management.

Table III showed the comparison of students' test scores between the flip classroom with and without group management using t-test independent. From the Table II, it showed that students' learning achievement of the experimental group, FC/G, ($\bar{X}$ = 12.46, SD = 1.69) was higher than the control group, FC, ($\bar{X}$ = 8.38, SD = 2.60) with statistically significance at 0.01 levels.

Note: *The average scores of the experimental group, FC/G, was higher that the control group, FC, even though the pre-test was lower at the beginning of the experiment.*

TABLE III: COMPARISON OF STUDENT'S LEARNING ACHIEVEMENT BETWEEN THE FLIP CLASSROOM WITH AND WITHOUT GROUP MANAGEMENT USING T-TEST INDEPENDENT

Type of teaching	N	$\bar{X}$	S.D.	t-test	Sig.
FC	24	8.83	2.60	5.910	.000**
FC/G	24	12.46	1.69		
					**p<0.01

The next step was to compare the students' improvement in both groups by using gain scores, the different scores of pre- and post-tests, and the comparison result was shown in Table IV. From Table IV, it was found that the students' gain scores of the flipped classroom with a group management ($\bar{X}$ = 8.20, SD = 2.54) was higher than the flipped classroom without a group management ($\bar{X}$ = 4.00, SD = 2.40) with statistically significance at 0.01 levels.

TABLE IV: COMPARISON OF DIFFERENCES IN STUDENT GAIN SCORES (POSTTEST-PRETEST) BETWEEN THE FLIPPED CLASSROOM WITH AND WITHOUT GROUP MANAGEMENT USING T-TEST INDEPENDENT

Type of teaching	N	$\bar{X}$	S.D.	t-test	Sig.
FC	24	4.00	2.40	5.241	.000**
FC/G	24	8.20	2.54		

**p<0.01

In the satisfaction survey result, there were three dimensions, facilitator, learning activities, knowledge sharing, in this research. According to Table V, the overall satisfaction, students were satisfied with the FC/G at the very high level ($\bar{X}$ = 4.29, SD = 0.61) and FC at high level ($\bar{X}$ = 4.11, SD = 0.41)., For each dimension, it found that students' satisfaction of FC/G in all dimensions were at very high levels, Facilitator ($\bar{X}$ = 4.28, SD = 0.46), Learning activities ($\bar{X}$ = 4.33, SD = 0.41), Knowledge sharing ($\bar{X}$ = 4.32, SD = 0.53), while students' satisfaction of FC were at high levels in all aspects, Facilitator ($\bar{X}$ = 3.98, SD = 0.49), Learning activities ($\bar{X}$ = 4.19, SD = 0.48), Knowledge sharing ($\bar{X}$ = 4.15, SD = 0.58) respectively.

TABLE V: THE STUDENTS; SATISFACTION OF THE FLIPPED CLASSROOM WITH AND WITHOUT GROUP MANAGEMENT USING T-TEST INDEPENDENT

Dimensions	N	FC			FC/G	
		$\bar{X}$	S.D.		$\bar{X}$	S.D.
Facilitator	24	3.98	0.49		4.28	0.46
Learning activities	24	4.19	0.48		4.33	0.41
Knowledge sharing	24	4.15	0.58		4.32	0.53
Average	**24**	**4.11**	**0.46**		**4.31**	**0.43**

Note: $\bar{X}$: 1.00-1.80 = very low, 1.81-2.60 = low, 2.61-3.40 = moderate, 3.41-4.20 = high, and 4.21-5.00 = very high

TABLE VI: COMPARISON OF DIFFERENCES IN STUDENTS SATISFACTION BETWEEN THE FLIPPED CLASSROOM WITH AND WITHOUT GROUP MANAGEMENT USING T-TEST INDEPENDENT

Type of teaching	N	$\bar{X}$	S.D.	t-test	Sig.
FC	24	4.11	0.41	2.854	.009**
FC/G	24	4.29	0.61		

**p<0.01

Table VI shows the difference of the overall students' satisfaction between FC and FC/G using t-test and the analyzed result showed that the FC/G ($\bar{X}$ = 4.29, SD = 0.61) had a better satisfaction than the normal FC ($\bar{X}$ = 4.11, SD = 0.41) with statistically significance at 0.01 levels.

V. CONCLUSION

The purpose of this research was to use social strategies

based on [11], [13] via a group management together with the flipped classroom technique as a classroom management tool to increase student achievement and satisfaction. From the analyzed results, it showed that the group management may improve student achievements and satisfaction. Normally, students always face many frustrations during the process of learning, and they may or may not find solutions by themselves. For students who cannot find a way, many of them just quit trying and wait for help, and, as a result, the tasks they are given may not carry out as planned. With the group management technique, therefore, when they encounter a difficulty situation and they can ask their friend who act as a mentor for advice, the process of learning can continue flawlessly.

In the case of shy students, it is very difficult to encourage them to participate in the class activities or to ask teachers for help [21], and, therefore, it is impossible to lead the whole class to the results expected by lecturers although they are fully prepared. Especially Asian students [4], [21], e.g., Thai students, they are shy and quiet, and they do not like to ask or to be asked by their teachers and it is very hard to find ones to raise their hands to answer/ask questions. Thus, some students always struggle with their tasks and do not ask their lecturers for help, but, usually, they ask their friends instead even though they do not obtain any correct answers. With the technique proposed, lecturers provide a resourceful person for them to ask for, and they can get advice immediately when they needed [22]. This is because they feel comfortable to ask their friends instead of their teachers and, by working together, it can develop collaboration and communication skills [23]. In some cases, however, if their mentors cannot find a good answer, they can still ask lectures for help. In this approach, it can give teachers a time to concentrate on some groups that really need help and it can also reduce students' waiting time when they need their teachers. In addition, for the mentor students, they could benefit from teaching their peers. This is because they can practice and evaluate their knowledge when they are teaching their friends [23], [24].

Conflict of Interest

The submitted work was carried out without any conflict of interest. Therefore, the authors declare no conflict of interest.

Author Contributions

Kanyuma Jitjumnong conducted the research and responsible for collecting all data and statistical analysis.

Surachai Suksakulchai was a research supervisor and responsible for statistical analysis and paper preparation.

All authors had approved the final version.

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References

[1] S. Y. Hwang and M. J. Kim, "A comparison of problem-based learning and lecture-based learning in an adult health nursing course," *Nurse Education Today*, vol. 26, no. 4, pp. 315-321, 2006.

[1] A. L. Marca and L. Longo, "Addressing student motivation, self-regulation, and engagement in flipped classroom to decrease boredom," *International Journal of Information and Education Technology*, vol. 7, no. 3, p. 230, 2017.

[2] Z. Zainuddin and S. H. Halili, "Flipped classroom research and trends from different fields of study," *The International Review of Research in Open and Distributed Learning*, vol. 17, no. 3, 2016.

[3] H.-N. R. Chu, *Shyness and EFL Learning in Taiwan: A study of Shy and Non-shy College Students' Use of Strategies, Foreign Language Anxiety, Motivation, and Willingness to Communicate*, The University of Texas at Austin, p. 215, 2008.

[4] G.-J. Hwang, T.-C. Hsu, and Y.-H. Hsieh, "Impacts of different smartphone caption/subtitle mechanisms on english listening performance and perceptions of students with different learning styles," *International Journal of Human–Computer Interaction*, 2019, vol. 35, no. 4-5, pp. 333-344, 2019.

[5] C.-C. Chiou *et al*., "Analyzing the effects of various concept mapping techniques on learning achievement under different learning styles," *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 13, no. 7, pp. 3687-3708, 2017.

[6] Z. Kablan, "The effect of manipulatives on mathematics achievement across different learning styles," *Educational Psychology*, vol. 36, no. 2, pp. 277-296, 2016.

[7] T. Seidel *et al*., "Teacher learning from analysis of videotaped classroom situations: Does it make a difference whether teachers observe their own teaching or that of others?" *Teaching and teacher education*, vol. 27, no. 2, pp. 259-267, 2011.

[8] S. McCallum *et al*., "An examination of the flipped classroom approach on college student academic involvement," *International Journal of Teaching and Learning in Higher Education*, vol. 27, no. 1, pp. 42-55, 2015.

[9] M. Rhalmi, *Teaching Large Classes: Problems and Suggested Techniques*, 2016.

[10] S. Suksakulchai and K. Jitjumnong. "Social strategies for a large classroom management," presented at International Conference on Learning Innovation in Science and Technology, Chiangmai, Thailand, 2014.

[11] K. Jitjumnong and S. Suksakulchai, "The effects of using social strategies for a classroom management," presented at International Conference on Learning Innovation in Science and Technology, Pattaya, Thailand, 2016.

[12] Y.-C. Cheng and H.-Y. Ku, "An investigation of the effects of reciprocal peer tutoring," *Computers in Human Behavior*, vol. 25, no. 1, pp. 40-49, 2009.

[13] X. Dong, "Application of flipped classroom in college English teaching," *Creative Education*, vol. 7, no. 9, pp. 1335-1339, 2016.

[14] A. Tóth, P. Lógó, and E. Lógó, "The effect of the kahoot quiz on the student's results in the exam," *Periodica Polytechnica Social and Management Sciences*, vol. 27, no. 2, pp. 173-179, 2017.

[15] E. Solmaz and E. Çetin, "Ask-response-play-leaRN: Students' views on gamification based interactive response systems," *Journal of Educational & Instructional Studies in the World*, vol. 7, no. 3, pp. 28-40, 2017.

[16] A. I. Wang, M. Zhu, and R. Sætre. "The effect of digitizing and gamifying quizzing in classrooms," presented at 10th European Conference on Game Based Learning (ECGBL), 2016.

[17] H. Bicen and S. Kocakoyun, "Perceptions of students for gamification approach: Kahoot as a case study," *International Journal of Emerging Technologies in Learning*, 2018, vol. 13, no. 2, pp. 72-93.

[18] D. T. A. Lin, M. Ganapathy, and M. Kaur, "Kahoot! It: Gamification in higher education," *Pertanika. Journal of Social Sciences & Humanities*, vol. 26, no. 1, pp. 565-582, 2018.

[19] D. H. Iwamoto *et al*., "Analyzing the efficacy of the testing effect using KAHOOTTM on student performance," *Turkish Online Journal of Distance Education*, vol. 18, no. 2, pp. 80-93, 2017.

[20] A. Masek and M. Masduki, "Participation of shy children during the Teaching and learning of basic psychomotor skill," *Social Sciences & Humanities*, vol. 25(S), pp. 55-66, 2017.

[21] D. Boud, R. Cohen, and J. Sampson, "Peer learning and assessment," *Assessment & Evaluation in Higher Education*, vol. 24, no. 4, pp. 413-426, 1999.

[22] D. Boud, R. Cohen, and J. Sampson, *Peer Learning in Higher Education: Learning from and with Each Other*, 2014, Routledge.

[2] C. Bulte *et al*., "Student teaching: Views of student near-peer teachers and learners," *Medical Teacher*, vol. 29, no. 6, pp. 583-590, 2007.

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