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The effect of a flipped classroom with online group investigation on students' team learning ability

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Abstract

This study examined the effects on the team learning ability of upper secondary school students using a flipped classroom model with online group investigation. The subjects of the study were 30 upper secondary school students. The instruments employed in the study consisted of: (1) a flipped classroom model with online group investigation, (2) a website for flipped classrooms, and (3) a learning management plan. The data collection instruments comprised: (1) a self-assessment form of team learning ability and (2) a team learning behaviour observation form. The study found that the average team learning ability of the learners was significantly higher after the lessons, and those with different learning abilities were able to learn as a team at significantly different rates. Post-hoc multiple comparison tests (LSD) revealed that the team learning ability scores of the learners with high learning ability differed significantly from those of the intermediate and beginner learning ability groups, while the team learning ability scores of the intermediate and the beginner groups were not significantly different. The beginner group scored the highest regarding team learning ability, followed by the intermediate group and the advanced group, respectively.

Introduction

The current instructional trend sets out to foster collaborative skills or team learning as one the 21st century learning skills. However, every milieu of our society now appears to be beset by conflicts, disunity, and divisiveness, which points to a general lack of understanding of how to co-exist in a society with individuals or groups of individuals who have different ideas and behaviour. Conflicts between individuals or groups of individuals are also common, even in educational institutions, with brawls between students regularly reported in the news. This results from a lack of understanding and the skills for cooperation and collaboration (Lawford, 2003; Mu & Gnyawali, 2003). Therefore, it is necessary for teachers to foster collaborative and team learning skills in students.

In the 21st century, various learning models have been developed to keep up with changes in social context and the advancement of science and technology. A flipped classroom is one such learning strategy that creates learning through technology. In addition to the flipped classroom strategy, learning approaches also form an integral part in developing team learning skills. A commonly employed learning approach is Group Investigation (GI), a collaborative learning model that encourages learners to work and communicate with each other through group

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processes for mutual benefits and for team achievement (Johnson, Johnson, & Smith, 2007). The GI model lends itself to fostering team learning in both regular and online classrooms. Therefore, the group investigation was integrated into the learning management of an online classroom and employed online collaborative learning tools.

As a flipped classroom with online group investigation could promote the team learning ability of upper secondary school students as demonstrated above, it was interesting to examine the effects of a flipped classroom with online group investigation in the enhancement of the team learning ability of upper secondary school students, which could be beneficial for future application of the model to other areas to develop students' team learning ability. Accordingly, the aim of the study was to examine the effects on team learning ability in upper secondary school students using a flipped classroom model with online group investigation. Below are the guiding research questions.

1. Does the use of a flipped classroom model with online group investigation promote team learning ability?
2. Do learners in the three proficiency groups (advanced, intermediate, and beginner) have different team learning abilities?

Literature Review

Flipped Classroom

A flipped classroom is an instructional strategy and a type of blended learning that reverses the traditional learning environment by delivering instructional content, often online, outside of the classroom. It is one such learning strategy that creates learning through technology, especially online video media, which helps reduce lecture time and increase the time for in-class activities where learners can learn cooperatively through practice (DeLozier & Rhodes, 2017; Jovanović, Gašević, Dawson, Pardo, & Mirriahi, 2017). Technology can support flipped classrooms by letting students gain first by exposure to new material outside of class, usually via reading or lecture videos and then using class time to do the harder work of assimilating that knowledge, perhaps through problem-solving, discussion, or debates. The growing accessibility and sophistication of educational technologies opens up increasing possibilities for students to explore, share, and create content (Bergmann & Sams, 2012). In addition, a flipped classroom has also been shown to promote not only students' sense of responsibility for their own work and self-regulation in assignment submission, but also their responsibility toward group assignments and classroom activities (Panich, 2013; Yilmaz, 2017).

Online Group Investigation (GI)

Group investigation (GI) is a collaborative learning model that encourages learners to work and communicate with each other through group processes for mutual benefits and team achievements (Johnson et al., 2007). Because it divides students into advanced, intermediate, and beginner groups, the GI model lends itself to fostering team learning in both regular and online classrooms (Khammani, 2007). The integration of group investigation learning into the learning management of an online classroom involves employing online collaborative learning tools designed to support group tasks, especially in terms of both synchronous and asynchronous communication, such as chat features, web boards, and brainstorming (Chou & Chen, 2008; Chrayah, El Kadiri, Sbihi, & Aknin, 2012). Because these tools also enable systematic collaborative information searching and management and allow learning to transcend time and place limitations, they lend themselves to the management of a flipped classroom and help promote team learning ability (Hall & Zarro, 2012).

Team Learning

Team learning focuses on the abilities of a group working together. It involves collaborative effort to achieve a common goal within the group and refers to the process by which students learn continuously and cooperatively with group members, with emphasis on teamwork in each step of the process, from learning and assisting each other to working together. The learning takes place through the transfer of skills by observing others in action, collective problem-solving and experimentation, questioning assumptions, and reviewing outcomes as a group. During this process, every member must keep in mind the notions of collaboration, work delegation, and mutual responsibilities toward problem solving, emphasizing the association between team success and the social skills of the individuals in teams (Riebe, Roepen, Santarelli, & Marchioro, 2010; Freeman, 2012).

Methods

The flipped classroom with online group investigation used a quasi-experimental one-group, pretest-posttest design.

Participants

The subjects of the study consisted of a class of 30 upper secondary school students at Singburi School in their second academic year in 2015. The school is located in the Singburi province, central region, *142* km from Bangkok, the capital of Thailand and has a population of 212,518. They were purposively sampled because the number of students was considered sufficient for the experiment and the school was also technologically equipped both in terms of support equipment and the Internet.

Materials and Tools

The instruments employed in the experiment were:

1. A flipped classroom model with online group investigation for the enhancement of team learning ability of upper secondary school students was developed, based on ideas,

theories, and studies related to flipped classrooms with online group investigation. The model was then reviewed by five experts and modified using their suggestions. Subsequently, the model was assessed and verified by the five experts. As its average suitability test score fell in the highest range ($\overline{X} = 4.75$, S.D. = .47), the prototype could be used in the experiment. The flipped classroom model consisted of six elements: 1) learners, 2) instructors, 3) web-based learning resources, 4) communication and interaction, 5) group activities for application, and 6) measurement and assessment. The model involved six stages: 1) group forming, 2) content presentation on the flipped classroom's website, 3) keeping learning logs, 4) search topic delegation, 5) knowledge exchange and production of final works, and 6) presentation.

2. The website for a flipped classroom with online group investigation was designed and developed in accordance with the concept of flipped classrooms with online group investigation, using a content management system (CMS) called Joomla (www.joomla.org). It is an open source platform to create web sites and applications (Patel, Rathod, & Prajapati, 2011). The website incorporated learning media, with emphasis on video media, as well as learning logs, exercises, and group activities such as knowledge exchange on web boards, the use of online bookmarking tool (i.e. pinterest.com) in collaborative research and data collection tasks, the use of online mind mapping tool (i.e. mindmeister.com) to collaboratively create mind maps online, and the use of online brainstorming tool (i.e. linoit.com) as an online note board for brainstorming. The quality of the website was assessed by three experts on educational technology and communications, and all the assessment items passed the quality test, with their scores in the highest range ($\overline{X} = 4.72$, S.D. = .47). The tests revealed that the website was efficient and ready for practical use.
3. The learning management plan for a flipped classroom with online group investigation is shown in Figure 1. The learning management plan was formulated in accordance with the procedure and elements of a flipped classroom for the learning unit on reconciliation and harmony. Afterward, the suitability of the plan was assessed by three social studies instruction experts, using the Index of Item-Objective Congruence (IOC) = .99.

Data Collection

The data collection instruments employed in the study were: 1) the observation form, using a four-point rubric to assess team learning behavior, with the content validity assessed by three experts, using IOC (IOC = .93); 2) The self-assessment form, using a five-point scale consisting of 23 items, where the content validity was assessed by three experts, using IOC (IOC = .97).

Data Analysis

1. Differential analysis of the averages of team learning ability obtained from the team learning ability self-assessment in the pretest and posttest used a dependent t-test.
2. Differential analysis of the averages of team learning ability obtained from the team learning behavior

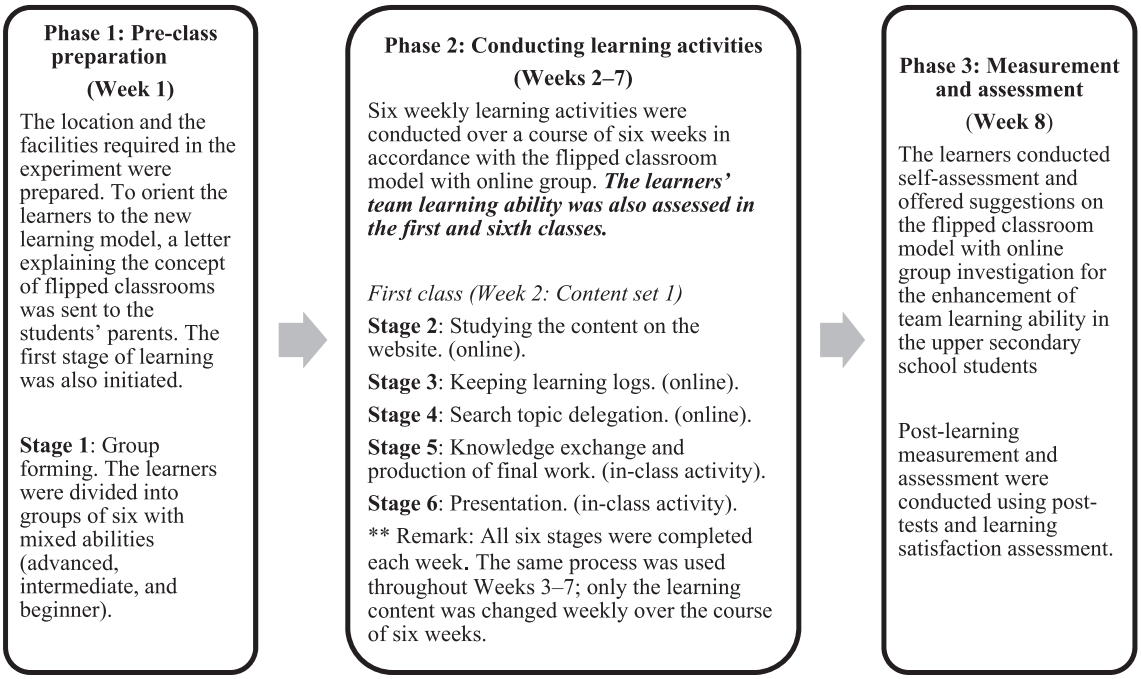

Figure 1 Learning management plan for a flipped classroom with online group investigation on students' team learning ability

observation in the pretest and posttest, used a dependent t-test.
3. Comparative analysis of the team learning abilities of the three proficiency groups, used one-way ANOVA and post-hoc multiple comparison tests (LSD)

Results

1) The differential analysis of the averages from the team learning ability self-assessment in the pretest and posttest revealed that the average team learning ability fell in the high range ($\overline{X} = 4.00$, S.D. = .09) in the pretest and was in the highest range ($\overline{X} = 4.57$, S.D. = .08) in the posttest, being significantly higher than that in the pretest, as shown in Table 1.

2) The differential analysis of the average team learning ability scores obtained from the observation of behavior as assessed by the researcher in the pretest and posttest revealed that the team learning ability was in the medium range ($\overline{X} = 18.17$, S.D. = .75) in the pretest and fell in the good range ($\overline{X} = 27.17$, S.D. = .78) in the posttest. The results demonstrated that the team learning ability scores from the observation of team learning behavior in the posttest were significantly higher than those in the pretest. In addition, the comparative analysis of the team learning ability scores from the observation of behavior as assessed by group members in the pretest and post test revealed that the team learning ability fell in the medium range ($\overline{X} = 18.00$, S.D. = .63) in the pretest and was in the good range ($\overline{X} = 27.67$, S.D. = .87) in the posttest, which showed that the team learning ability scores from the observation of team learning behavior as assessed by the group members in the posttest were significantly higher than those in the pretest as well.

3) The comparative analysis of the team learning ability scores of the three proficiency groups obtained from the team learning ability self-assessment form revealed that learners in the three proficiency groups scored significantly differently on team learning ability, as shown in Table 2. Therefore, post-hoc multiple comparison tests (LSD) were conducted. It was found that the advanced learners scored significantly differently on team learning ability from the intermediate and beginner learners, while the scores of the two latter groups did not differ significantly. The beginner learners were found to score the highest on team learning ability ($\overline{X} = 4.49$), followed by the intermediate group ($\overline{X} = 4.61$) and the advanced group ($\overline{X} = 4.63$), respectively. The team learning ability scores of the intermediate and the beginner groups did not differ significantly, as shown in Table 3.

Table 1
Comparative analysis of the averages of team learning ability obtained from the team learning ability self-assessment form administered in the pretest and post test

Team learning ability	N	Mean	SD	t	*p*
Pre test	30	4.00	.09	−26.122	.000
Post test	30	4.57	.08		

Table 2
Comparative analysis of team learning ability of learners with different learning abilities

Variance	Sum of Squares	df	Mean Square	F	*p*
Between groups	.116	2	.058	20.484	.000
Within groups	.076	27	.003		
Total	.192	29			

Table 3
Post-hoc multiple comparison tests (LSD)

Learning abilities	Average	Advanced	Intermediate	Beginner
		4.49	4.61	4.63
Advanced	4.49	–	−.115*	−.141*
Intermediate	4.61		–	− .025
Beginner	4.63			–

* $p < .05$

Discussion

From this study of the team learning ability of upper secondary school students after the utilization of a flipped classroom with online group investigation, it was found that the average team learning ability scores obtained from the team learning ability self-assessment form administered in the pretest and post test, were significantly higher in the posttest than those of the pretest. This was consistent with the team learning ability scores obtained from the rubric for observation of team learning behavior as assessed by the researcher and by group members. Overall, the students' team learning ability scores in the posttest were significantly higher than those in the pretest, which demonstrated that the flipped classroom model with online group investigation can enhance team learning ability in students. Due to the fact that the researcher adhered to the stages of the flipped classroom model with online group investigation, which involved group forming, in which the learners were divided into groups of six with mixed proficiency levels, each group's members learned and worked cooperatively as well as helping each other to achieve their goals, thus establishing team learning ability in learners. This corresponds with a study by Johnson et al. (2007), which stated that learners should be divided into groups of four to six, consisting of advanced, intermediate, and beginner learners, so that they can assist each other, form a common goal, and take on both their own and their group's responsibilities to achieve mutual success. Moreover, the content presentation on the flipped classrooms website in the form of video media, for which learners were required to study before coming to class, allowed them to review the content as many times as they needed to achieve full comprehension of the lessons. This promoted the learners' sense of responsibility for studying the contents of the lesson before coming to class. This was consistent with findings by Bergmann and Sams (2012), who stated that a shift from lectures by instructors in class towards out-of-class learning through videos that present contents can encourage learners to summarize what they have learned and prepare them for activities from the videos used to introduce new lessons in class. After learning from the instruction videos, learners are expected to keep a

learning log, exchange the knowledge they have learned with their friends, and complete an online test. These activities help students learn individually by summarizing the knowledge they have gained into their learning logs as well as collectively by exchanging with fellow learners, which initiates team learning. This was correlated to the findings of DeLozier and Rhodes (2017), who stated that in the flipped classroom model, teachers can adapt a variety of online tools to carrying out knowledge sharing activities online, for instance, assigning learners with topics to summarize along with completing tests for the learners' own self-assessment. In addition, the search topic delegation stage illustrates the ability of collaborative learning through the connection between teacher and student as well as student and student, which encompasses discussions, planning, and the exchanging of ideas. This was consistent with Slavin (1995), who stated that group investigation would be incomplete if it lacked communication between individuals, and collaboration amongst learners, considering it to be successful for small group learning. In addition, the knowledge exchange and final work production stage proved to be a worthwhile and beneficial use of time as it allowed the learners to learn from activities fully as well as promoting collaborative learning through group activities. This was in line with Bergmann and Sams (2012), who stated that the flipped classroom model allows students to fully engage in learning activities that enrich and expand their knowledge. Similarly, the results also correspond with a statement by Schoolwires (2013) that a flipped classroom must feature application through group projects or group activities where learners work together. Lastly, the presentation stage appeared to promote openness to comments and acceptance of the learners' own flaws and that of the group, which could be used to improve their future endeavors, furthermore it also allowed learners to evaluate others. This stage corresponds with an idea put forward by Slavin (1995) that several forms of presentation must be incorporated in the class. Everyone must pay attention to and participate in the presentation of each group.

Furthermore, it was found that the learners in the three proficiency groups (advanced, intermediate, and beginner) scored significantly differently on team learning ability, with the team learning ability of the advanced learners diverging significantly from that of the intermediate and beginner learners. The beginner learners were found to score the highest on team learning ability, followed by the intermediate group, and the advanced group, respectively. The team learning ability scores of the intermediate and the beginner groups did not differ significantly. The results corresponded with the Myers-Briggs Type Indicator, which posits a Thinking/Feeling preference pair based on learners' decision-making processes. Learners in the Thinking group make rational decisions based on rules. These learners are usually ranked as advanced in learning proficiency. On the other hand, those in Feeling group make decisions based on feelings as well as personal and collective values and tend to pay attention to people-related problems; they are generally good at interpersonal communication and they usually excel in group tasks. These learners are usually ranked as intermediate and beginner in learning proficiency (Briggs & Myer, 1987; Grasha, 1984).

Overall, the flipped classroom model with online group investigation that was designed by the researcher for learners allowed them: to carry out different activities as a team; to manage their learning as a team; and to establish in learners a sense of responsibility and the ability to learn as an individual, the ability to work together to complete certain goals, the ability to communicate with one another, the ability to interact, and the ability to evaluate with others. This led to enhancement of team learning ability in upper secondary school students through the utilization of the flipped classroom model with online group investigation.

Conclusion and Recommendation

The results showed that a flipped classroom with online group investigation could foster team learning ability in upper secondary school students. Therefore, according to the research findings, the following recommendations on future applications should be addressed. Since this model centers around the Internet and communication between instructors and students and between students, the availability of necessary equipment such as computers and the Internet, as well as the skills required for information searching and communication, are paramount. The content selection should be appropriate for this learning management model such as lecture-based contents that learners can re-watch for comprehension and contents that require demonstrations or experiments involving dangerous substances and can be filmed as demonstration videos. This model that allows learners to become responsible for their own learning. Therefore, this model can be applied to foster other qualities such as a sense of responsibility. Furthermore, a flipped classroom can be applied in tandem with other teaching methods such as project-based learning and problem-based learning.

Conflict of Interest

There is no conflict of interest.

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