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Research Article

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Think-pair-share based flipped classroom: A model for improving students' learning achievement and self-efficacy

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ABSTRACT

The lack of clear instruction and teaching strategy during the in-class learning activities of flipped classroom (FC) model has affected the model's efficacy. This study aims to improve FC model by proposing the think-pair-share-based flipped classroom model (TPS-FCM). This study investigates the effect of TPS-FCM on students' academic achievement and self-efficacy in an information and communications technology (ICT) in education course. One hundred and seventy-three students were involved in the quasi-experimental study. The students in the experimental group (n=91) learned with TPS-FCM, and students in the control group (n=82) used the conventional flipped classroom model (CFCM). Pre-test, post-test, and survey were employed. Results showed that TPS-FCM significantly improved students' ICT learning achievement and self-efficacy compared to CFCM. Gender was found to have been significantly affected by TPS-FCM in students' learning achievement but not in self-efficacy. This study recommends think-pair-share (TPS) strategy to improve in-class activities in FC model. Moreover, the study has limitations because of using two different teachers, which might affect students' learning achievement and self-efficacy. Nonetheless, this study contributed that integrating TPS into FC model improves in-class learning activities. Integrating TPS into the in-class learning activities proved the budding support to enhance the efficacy of FC model. Based on the results of this study, the authors suggested that flipped practitioners can use the think-pair-share strategy to minimize in-class issues, particularly the lack of clear instruction and teaching strategy. Many practical studies of FC model have already been conducted. The originality of this work is in the fact that it proposes a suitable strategy (TPS) to improve the in-class learning activities of the model. The study also explores the effect of the proposed model on students' learning achievement and self-efficacy, which enrich the current literature.

Keywords: think-pair-share, flipped classroom, learning achievement, self-efficacy, ICT

INTRODUCTION

The traditional teaching method is the most widely used teaching approach in education. This teaching mode centers on teachers, who are the leaders and controllers of the class. Teachers control the process and teaching content, while students follow teachers to complete the learning of the content. Such a teaching approach has been confirmed to be ineffective for practical-based courses; students are not able to control their learning pace (Shakibaei et al., 2019); they can passively accept the learning process in which the teacher dominates. Using traditional methods in information and communications technology (ICT) courses gives limited time for practical activities, leading to inadequate students' ICT skills, learning achievement, and self-efficacy (Samaila et al., 2022). In addition, ICT courses in some universities generally have large class sizes, meaning every student can only receive a limited amount of teachers' instruction, guidance, and feedback (Sani et al., 2016).

Flipped classroom (FC) model can potentially improve traditional teaching method by allowing the students to access the learning materials and acquire basic knowledge before class hours (Efiuvwere & Fomsi, 2019). This ensures that the students spend more time in the class, interact with learning materials and get involved in the knowledge construction. By spending more time in the classroom, the students can work together, solve complex problems, and engage in collaborative and meaningful discussions (Lin et al., 2019), the learning achievement and confidence of students are expected to be improved (Samaila et al., 2021c). FC model is a student-centered approach that supplements the teacher-centered approach and increases the quality of teaching and learning (Kurt, 2017; Samaila et al., 2021b). It is a pedagogy in which

lecture is moved beyond the traditional classroom. At the same time, in-class time is devoted to group discussion, learning collaboration, and problem-solving (Nederveld & Berge, 2015). One way to manifest such a model is by employing asynchronous online instructional videos as lectures, work on the given problems before class hours, and group-based discussions during school class time (Bishop & Verleger, 2013).

Compared to the traditional model, FC model is more effective in helping students achieve better academic performance (Strelan et al., 2020; Zainuddin et al., 2019) because students are more prepared before class hours, and they can review recorded videos repeatedly (Heijstra & Sigurðardóttir, 2018). However, there needs to be more in FC model, especially during in-class sessions. For instance, proper instruction, discussion guidelines, structured teaching strategies, and time management are needed during the in-class learning session (Kim et al., 2014; Lai & Hwang, 2016). Certain initiatives, such as gamification, game-based learning, problem-based learning, and experiential learning, had been previously integrated into FC model to improve the quality of the in-class session (Huang et al., 2019; Zhai et al., 2017). Yet, there is a need to incorporate simple and clear teaching strategies such as think-pair-share (TPS) in FC model to get the best out of the in-class session of FC model (Velazquez, 2020). Therefore, this study contributes to the body of existing knowledge by evaluating the effect of the proposed TPS-based FC model on students' ICT learning achievement and self-efficacy. The findings of this study might assist flipped educators and curriculum designers by providing a new research-based foundation for improving in-class sessions of FC model.

In FC environment, teachers play a vital role. For instance, they usually become supervisors or facilitators in FC (Xu & Shi, 2018), while students assume greater responsibility for learning independently (Raman et al., 2019). The traditional classroom that strictly requires the students to follow the teacher's schedules (Samaila et al., 2021a; Vighnarajah et al., 2008) limits the students' creativity and communication (Dauda & Samaila, 2019; Li et al., 2014). Studies are required to understand whether students' achievement and gender representations are side effects of learning in FC model (Namaziandost & Cakmak, 2020). Likewise, future research needs to be conducted to investigate whether FC model can affect students' self-efficacy and, if so, how this effect might be associated to gender in the teacher education program (Chen et al., 2019; Kurt, 2017). Driven by this assertion, the study employed TPS strategy to improve the in-class teaching strategy of FC model. This study used quasi-experiment to investigate the effect of the proposed TPS-based FC model and gender on Nigerian students' ICT learning achievement and self-efficacy. The study potentially helps flipped educators to accommodate the large class size; creates adequate time for practical ICT activities; provides clear instruction during in-class session of FC model; and improves students' ICT learning achievement and self-efficacy. The study further assists the researchers to understand the effect of gender on implementing TPS-based FC model.

LITERATURE REVIEW

Impact of Flipped Classroom Model on Students' Achievement

In an FC, lectures are delivered through online or offline videos before class time, leaving class time free for direct interaction with the learning materials and group discussions. The model allows students to review recorded instructional video lectures repeatedly, which leads to higher leaners' academic performance (Sen, 2022). A meta-analyses reported that FC model improved students' learning outcomes compared to the traditional model of teaching (Sulong et al., 2021; Zainuddin et al. 2019). Scholars believe that when FC model is utilized appropriately, it gives positive learning outcomes (Emelda et al., 2019; Masood et al., 2022). However, there is little research on how FC model affects students' learning success, especially in ICT classes (Huang & Hong, 2016; Wen et al., 2016).

Previous literature suggests that FCs may produce benefits such as increasing test scores, improving students' learning performance, and providing valuable benefits for students with special needs (Flipped Learning Network, 2014; Samaila & Al-Samarraie, 2023). Ode's (2017) study about computer science in Nigeria showed that an FC reduces the students' failure to learn. In addition, FC advocates proclaim that this practice enhances teacher-student interaction, provides a student-centered learning environment, and increases students' engagement in class. Although Fraga and Harmon (2014) found no significant differences between the flipped model and the traditional model in terms of academic achievement, the research further revealed different factors that may influence the effectiveness of this way of teaching and learning, including topic considerations, participant preferences, and participant learning styles.

Limited research has been done on how FC model affects pupils of different genders regarding learning achievement in ICT courses (Chen et al., 2016). A study reported that male students had better learning achievement in technology course (Tyler & Yessenbayeva, 2018). Even though male students have a favorable view of ICT and utilize it to improve their learning (Adigun et al., 2015; Mustafa, 2014), female students outscored male students (Gebhardt et al., 2019). On the other hand, Alhasani (2017) found that gender did not significantly affect students' achievement. Few studies investigated the effect of gender in FC model. This leaves a research gap in the body of knowledge. Therefore, this empirical study fills this gap by including gender in the proposed think-pair-share-based flipped classroom model (TPS-FCM). Thus, this study formulated the following hypotheses:

- **H_{01}.** There is no significant difference between instructional methods (TPS-FCM and CFCM) on students' achievement when learning ICT in Education course.
- **H_{02}.** There is no significant difference between gender (male and female) in students' achievement when learning ICT in education course.

Use of Flipped Classroom Model to Increase Students' Self-Efficacy

Typically, students are expected to develop confidence and self-efficacy after attending a specific training and are subsequently ready to transfer the knowledge and skills to their future classrooms (Bello et al., 2023; Brush et al., 2008). The flipped teaching strategy has been more successful in improving students' self-efficacy than the traditional model. For example, the researchers (Khan & Ibrahim, 2017) employed FC model to instruct undergraduates in a technology course. The results indicated that when students used FC model, their belief and confidence to integrate technology in the future improved. This is because the students in FC model were more prepared before the class hours and got more involved in the learning activities. Previous studies reported that if the in-class session of FC model can be used effectively, the students' self-efficacy will improve significantly (Kurt, 2017; Long et al., 2018).

Kurt (2017) observed that developing students' self-efficacy beliefs and learning experiences has become a significant concern of higher education institutions. Hence, he used FC model to enhance students' self-efficacy beliefs and learning outcomes in a classroom management course. Results showed that students who used FC had higher self-efficacy and learning outcomes than their counterparts who used the conventional classroom. Hsia et al. (2019) believe that if FC model is supported with extra activities such as a watch-summary-quiz, the students' self-efficacy, and learning performance will improve. Similarly, the experimental studies showed that FC model not only improved students' technical skills but also significantly increased their self-efficacy and critical thinking tendency (Lin et al., 2019).

Moreover, literature indicated that compared to the traditional FC model, the problem-posing-based FC approach was more applicable and effective at fostering students' self-efficacy and academic accomplishment (Ye et al., 2019). The problem-posing strategy allowed the students to ask questions and interact with peers and lecturers. Females possessed better self-efficacy than male students (Namaziandost & Cakmak, 2020). However, gender was found to have non-significant gender variations in self-efficacy in science and mathematics classes (Sezginturk & Sungur, 2020; Vogel & Human-Vogel, 2016). Moreover, understanding the role of gender will give flipped educators and faculty members more insights in response to designing and implementing FC model. Therefore, the following hypotheses were framed:

- **H_{03}.** There is no significant difference between instructional methods (TPS-FCM and CFCM) on students' ICT self-efficacy when learning ICT in education course.
- **H_{04}.** There is no significant difference between gender (male and female) in students' ICT self-efficacy when learning ICT in education course.

Think-Pair-Share-Based Flipped Classroom Model

FC concept has numerous major drawbacks, including students' disengagement before class and unclear instructions during the in-class learning session (Cakiroglu & Ozturk, 2017; Kim et al., 2014). This underscores the need to improve the in-class teaching strategy of FC model. FC model has been modified to incorporate several teaching methods, such as project-based learning, gamification, and experiential learning, to support classroom activities and improve student learning (Huang et al., 2019; Zou, 2020). A simple, easy-going, and flexible learning theory is needed to improve in-class learning activities (Masood et al., 2022). For example, embedding TPS strategy into FC model might help students to have a clear learning strategy during the in-class learning activities (Peethambaran et al., 2018). With this approach, students can actively participate in their education and are not allowed to simply watch as others complete their tasks.

TPS strategy has three phases: *think*, *pair*, and *share*. During the thinking phase, the teacher gives a task for students to solve (e.g., create ten presentation slides and apply slide animation and transition to all the slides) while students work individually to complete the given tasks. This phase of 'think' can support students to understand their responsibilities as individuals with different learning styles. The phase clearly defines students' activities in the first 30 minutes during the in-class activities of FC model. This increases the quality of FC model, thereby improving students' active participation and contribution to the learning process.

In the second phase, *'pair',* students work in pairs to achieve the above tasks while the teacher monitors students' activities. This phase allows the students to collaborate with other students for deep learning and critical discussion. At this phase, FC model provides a conducive environment for students to work in pairs to achieve the stated objectives. Using student-centered learning (pair tutoring) in FC model assisted students in interacting with colleagues and learning more. This also helped the students develop self-efficacy.

During the third phase, *'share'*, the group members share their expertise and experiences with the other class members. The sharing phase plays a more significant role in this study. As FC model allows the students to acquire basic knowledge before the class, they have a designated phase, 'share,' where they interact and share their experiences with other class members. This shows that if TPS is tactically and strategically integrated into FC model, students can share their thoughts and learn from others. **Figure 1** shows teachers' and students' activities during TPS teaching and learning strategies.

Pre-class, in-class, and post-class sessions comprise the three parts of the think-pair-share-based flipped classroom (TPS-FC) concept. During the pre-class session, the students examine the learning materials and watch instructional videos to acquire basic knowledge. The in-class sessions result in the students acquiring a high level of knowledge. The post-class session includes presentations, summative evaluation, and self-assessment. The activities of the students in each section of FC model are shown in **Figure 2**.

METHODOLOGY

Research Design

Ten-week quasi-experimental study involved undergraduate students from Nigeria. The study includes two dependent variables–students' learning achievement and ICT

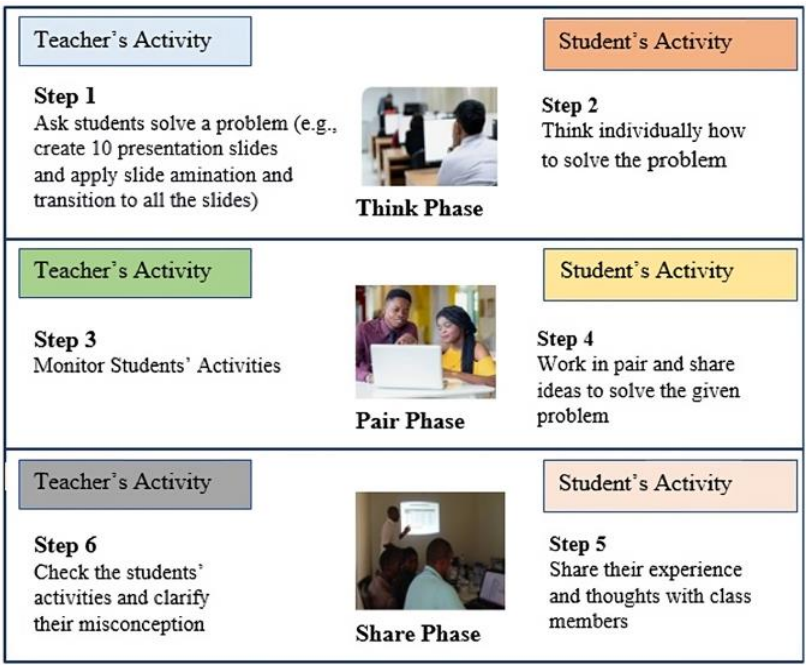

Figure 1. Teacher & student's activity during TPS activity (Source: Authors)

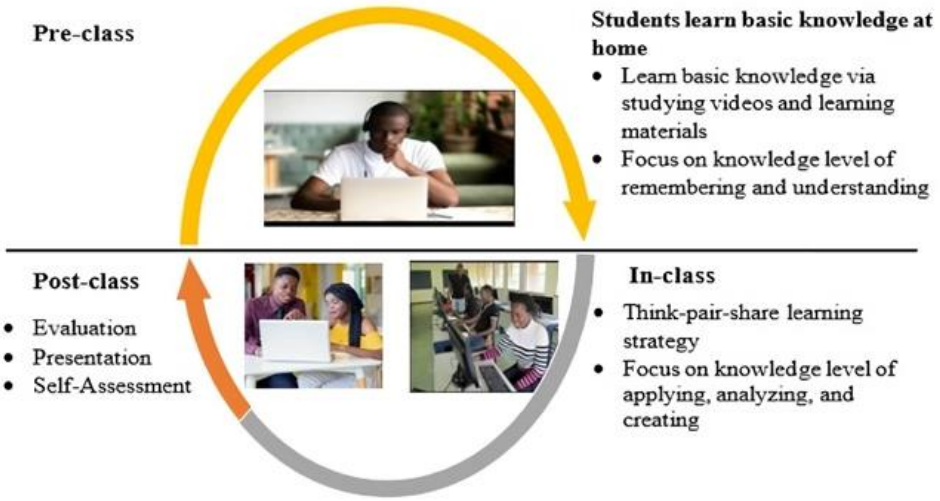

Figure 2. TPS-FC model (Source: Authors)

self-efficacy–two independent variables–the instructional technique (think-pair-share based flipped classroom model and traditional flipped classroom model) –and one moderator variable–gender.

Participants

One hundred and seventy-three students enrolled in a course introduction to ICT in education during the second semester of 2022 made up the participants. The participants were second-year undergraduates at the department of chemistry education. A convenience sampling technique was used to assign 91 students to TPS-FC model group and 82 students to CFC model group.

Instrument

The researchers used a curriculum of the 'ICT in education' course to develop a learning achievement test consisting of 25 multiple-choice questions. The curriculum consists of five units.

1. concepts of ICT,
2. computer and file management,
3. application software of Microsoft Word, Microsoft Excel, and Microsoft PowerPoint,
4. computer hardware and software, and
5. ICT and pedagogy.

Five questions were developed from each unit. Each question had an option from A to D. Examples are: "Which of the following is a "brain" of a computer?" "How do you open a program such as Microsoft Word when there are no icons on the desktop?" Both the experimental and control groups used this learning achievement test.

A Likert-type survey measuring students' ICT self-efficacy was adopted from the work of Wang et al (2004). ICT self-efficacy is the term used to describe students' trust in their ability to use ICT in the classroom. Sixteen items made up the questionnaire. Participants were asked to score statements

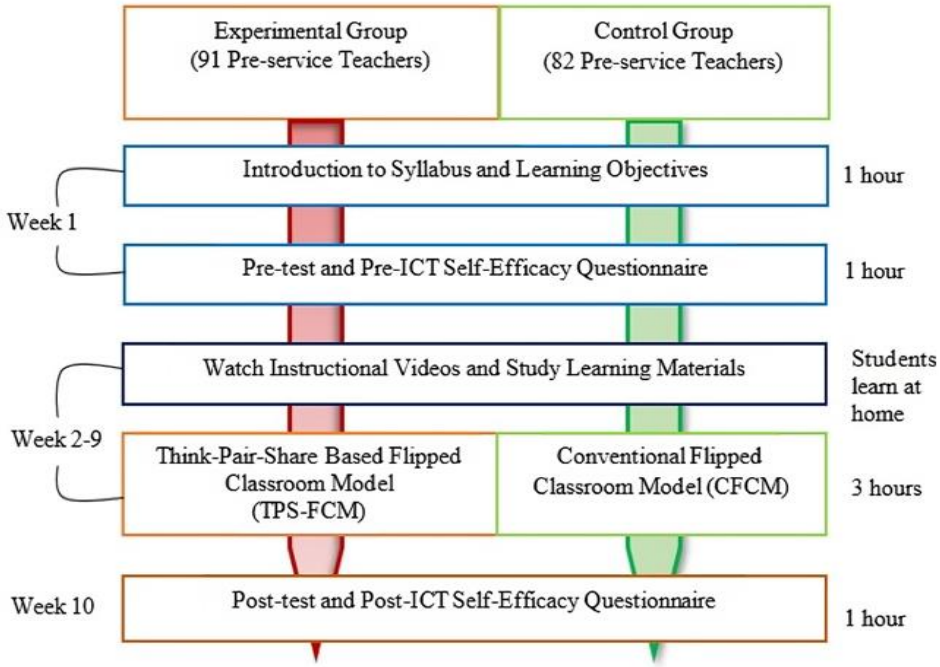

Figure 3. Experimental design (Source: Authors)

about their confidence on a scale of one to five based on how strongly they agreed with each statement. For example, "I feel confident that I have the necessary skills to use ICT resources for instruction." "I feel confident that I can effectively monitor students to use ICT resources in my classroom." Three experts reviewed and validated the questionnaire.

Reliability

Kuder-Richardson formula 20 (KR-20) was used for a learning achievement test to measure the internal consistency reliability. This is because each question had only two answers: right or wrong. The result of the reliability test for the learning achievement test is 0.79.

For a questionnaire measuring students' ICT self-efficacy, an SPSS software was used to calculate the value of Cronbach's alpha. This is the most commonly used method when multiple Likert questions in a survey/questionnaire form a scale. ICT self-efficacy questionnaire's reliability score is 0.84.

Validity

Four ICT and instructional technology experts and a course tutor validated the achievement test. These experts have more than ten years of teaching experience. Their observations and suggestions were few but constructive. They advised that the questions should be reduced from 30 to 25. The experts' advice and suggestions helped the researcher to have the final test that consisted of 25 questions. The same experts validated the self-efficacy questionnaire. According to them, 16 items of the questionnaire were properly designed and capable of measuring what they were designed to measure based on the study's objective.

Learning Materials

The learning materials of this study were on ICT in education. Three experts validated the materials before the intervention. The students across the groups received identical learning materials. The lecturers uploaded the learning materials on the learning management system while the students watched the materials to gain basic knowledge before class.

Experimental Procedure

Figure 3 shows the experimental procedure. In the first week, the instructor gave the participants an overview of the curriculum and learning goals. A pre-test was then completed by the participants from both groups (n=173). From the second to the ninth week, the lecturer uploaded instructional videos on the learning management system for each the students to watch before the class hour. The experimental group's students had their in-class activities using TPS strategy. The students in the control group carried out their in-class activities without using TPS strategy. Students in the experimental group were required to give presentations and complete self-evaluations as part of the post-class activities. Just a presentation was required for the students in the control group. Students from both groups had to take all the post-tests in week 10.

RESULTS

Before the preliminary analyses, the researchers used the IBM-SPSS version 22 to screen the data. Shapiro-Wilk test was used to examine the normality of the data. The result of this test, p=0.87, was not significant at .05, indicating that the data of this study were normally distributed and free from apparent patterns or clusters.

Descriptive Statistics

Table 1 shows students in TPS-FCM group had higher learning achievement post-test mean scores and standard deviation (mean [M]=67.076, standard deviation [SD]=13.825) compared to those in CFCM group (M=58.520, SD=9.764). It indicates that the mean scores across the groups have differed.

Table 1. Mean & standard deviation scores of students' learning achievement & self-efficacy by group

Variable	TPS-FCM (n=78)		CFCM (n=73)	
	Mean	Standard deviation	Mean	Standard deviation
Pre-test for learning achievement	47.025	12.046	45.025	11.772
Post-test for learning achievement	67.076	13.825	62.274	8.544
Self-efficacy	67.910	6.589	62.274	8.544

Table 2. Mean & standard deviation scores of students' learning achievement & self-efficacy by gender

Variable	TPS-FCM (n=94)		CFCM (n=57)	
	Mean	Standard deviation	Mean	Standard deviation
Pre-test for learning achievement	44.851	12.304	48.842	10.162
Post-test for learning achievement	64.766	13.392	59.929	11.045
Self-efficacy	66.361	7.410	63.245	8.818

Table 3. Test of homogeneity of variance of achievement & ICT self-efficacy

Variable	Levene statistics	df1	df2	p
Achievement test	.009	1	149	.923
ICT self-efficacy	1.775	1	149	.185

Table 4. Two-way ANCOVA result of students' achievement post-test scores

Source	SS	df	MS	F	p	Partial η^2
Treatment	1,563.471	1	1,563.471	11.792	.001	.075
Gender	634.148	1	634.148	4.783	.030	.032
Error	19,357.554	146	132.586			
Total	622,528.000	151				

For self-efficacy, **Table 1** showed that students in TPS-FCM group had higher self-efficacy mean scores (M=67.910, SD=6.598) than those in CFCM group (M=62.274, SD=8.544).

Table 2 reported that male students had high learning achievement post-test mean scores (M=64.766, SD=13.392) than female students (M=59.929, SD=11.045). It means that male students performed better than their counterparts. With respect to self-efficacy, **Table 2** revealed that male students had higher self-efficacy mean scores (M=66.361, SD=7.410) while female students had less self-efficacy mean scores (M=63.245, SD=8.818).

Analysis of Students' Learning Achievement

The result of Levene's test (p=.923) shows that the homogeneity of variance for the achievement test was not violated. It indicates that analysis of covariance (ANCOVA) can be used to explain the students' learning achievement in the two groups (see **Table 3**).

Table 4 showed that after controlling the effects of pre-test scores, the treatment (TPS-FCM and CFCM) indicates significant differences in the students' learning achievement F(1, 146)=11.792, p<.05. The effect size η^2=0.075 convey difference magnitude between the groups. This indicates a medium effect between independent variable (teaching method) and dependent variable (learning achievement).

Table 5 examines the magnitude of the significant effect across the treatment groups. The results show that the adjusted mean score of TPS-FCM (M=65.583) was significantly higher than that of CFCM (M=58.713).

Table 5. Estimated marginal means for achievement post-test score by treatment

Group	Mean	Standard error	95% confidence interval	
			Lower bound	Upper bound
SSQ FLM group	65.583[a]	1.474	62.671	68.496
CFLM group	58.713[a]	1.349	56.047	61.379

Table 6. Estimated marginal means for achievement post-test score by gender

Group	Mean	Standard error	95% confidence interval	
			Lower bound	Upper bound
SSQ FLM group	64.363[a]	1.225	61.942	66.784
CFLM group	59.933[a]	1.594	56.782	63.083

Table 7. Summary of two-way ANOVA result of ICT self-efficacy scores

Source	SS	df	MS	F	p	Partial η^2
Treatment	948.809	1	948.809	16.440	.000	.101
Gender	112.285	1	112.285	1.946	.165	.013
Error	8,483.793	147	57.713			
Total	651,427.000	151				

Analysis of Students' Learning Achievement on Gender

Table 6 indicates that there is a significant effect of gender on students' achievement scores F(1, 146)=4.783, p<.05. **Table 6** reported that male students had higher adjusted mean scores (M=64.363) than female students (M=59.933) in achievement post-test scores.

Analysis of Students' ICT Self-Efficacy

Levene's test (p=.185) indicates that the homogeneity of variance for ICT self-efficacy was achieved (see **Table 1**). The results of a two-way analysis of variance (ANOVA) reported that treatment (TPS-FCM and CFCM) had a significant difference in students' self-efficacy F(1, 147)=16.440, p<.05 (**Table 7**).

The estimated marginal means of treatment groups were calculated to determine the magnitude of the significant effect across the treatment groups.

Table 8 reported that students in TPS-FCM had higher ICT self-efficacy mean scores (M=67.593) than students in CFCM (M=62.258). The effect size η^2=0.101 convey difference magnitude between the groups. This indicates a large effect

Table 8. Estimated marginal means for achievement post-test score by treatment group

Group	Mean	Standard error	95% confidence interval	
			Lower bound	Upper bound
SSQ FL group	67.593	.970	65.677	69.509
CFL group	62.258	.889	60.501	64.016

between independent variable (teaching method) and dependent variable (ICT self-efficacy).

Analysis of Students' ICT Self-Efficacy on Gender

The experimental results of a two-way ANOVA revealed that gender had no significant effect on students' ICT self-efficacy $F(1, 147)=1.946$, $p>.05$ (**Table 7**).

DISCUSSION

This study proved that TPS-FC model improved the quality of the in-class learning activities and assisted the students in interacting with their peers and teachers. The findings justify that TPS teaching strategy can offer a conducive learning environment for students to collaborate, discuss, and learn from each other. Students can monitor their learning progress, seek help, where necessary, work in groups, and utilize the knowledge from the video lecture to solve real ICT problems. This is consistent with the previous studies' findings (Jian, 2019; Peethambaran et al., 2018). The results are likewise in line with those of Ye et al.'s (2019) study, which used a flipped learning strategy based on interactive problem-posing to raise students' self-efficacy and academic accomplishment. Their research revealed that problem-posing guided flipped learning students had higher levels of self-efficacy and accomplishment than those who received instruction using the traditional FL methodology. The students could plan and think ahead for group discussions and peer interactions due to the interactive problem-posing guiding technique. Similar to that study, this one allowed students to work independently before coming together to continue working on their assignments in class. Contrary to the findings of this study, research conducted by Fraga and Harmon (2014) found that no FC model had a significant effect on students' academic achievement. However, the findings of this study agreed with that of Ode (2017), who reported that the FC model reduces the students' failure to learn.

We noticed that TPS strategy in FC brought about the vicarious experience in learning amongst the students, where the weak students observed the best students modelling an ICT task(s). The best students provided average (struggling) learners with direct guidance about integrating ICT facilities in the classroom. The struggling learners took advantage of TPS strategy, especially during the 'pair' session, to systematically observe their colleagues, thereby developing the internal imagery they need to conceptualize and implement targeted skills (Margolis & Mccabe, 2006). Results showed that when FC model is supported with TPS strategy, students' ICT self-efficacy will be improved significantly. Similar findings were reported when FC model was supported with extra activities such as a watch-summary-quiz (Hsia et al., 2019); the students' self-efficacy and learning performance were significantly enhanced. Other studies revealed that the FC model was a better strategy for improving students' self-efficacy than the traditional teaching method (Khan & Ibrahim, 2017; Kurt (2017). Similarly, the experimental study demonstrated that the FC model was capable of cultivating students' technical skills, self-efficacy, and critical thinking tendency (Lin et al., 2019).

The results indicated that learning achievement varied by gender. Comparing adjusted mean scores between genders, male students performed better. According to earlier studies, this is likely because male students had more favorable opinions toward ICT than female students (Adigun et al., 2015; Mustafa, 2014). Another reason male students performed better than female students was because the instructors were males; this allowed male students to interact, ask, and seek clarification more than female students. This assisted the male students to participate and be involved in the learning process, thereby improving their learning achievement and ICT self-efficacy. The roles that male students played during the learning process are another potential explanation for their superior accomplishment. The roles include managing the group's activities and planning extracurricular activities. On the other hand, students' ICT self-efficacy was not significantly impacted by gender. The change in teaching methodology from the conventional lecture-based approach to FC model may be responsible for the insignificant effects of gender (Rohatgi et al., 2016). This is in line with earlier research, particularly in the flipped learning environment, which found that gender had no impact on students' self-efficacy (Sezginturk & Sungur, 2020; Vogel & Human-Vogel, 2016). The insignificant effect of gender on students' ICT self-efficacy could be attributed to the different learning styles in FC model. It allowed all students to use different learning styles and learner-centered approaches in the learning process without gender differences (Tyler & Yessenbayeva, 2018).

Limitations & Feature Studies

The study was limited to only quantitative research; no probability sampling techniques were used. Another limitation of this study was lack of qualitative data to supplement the shortage of the quantitative data. Therefore, the findings cannot be generally applied to other educational institutions. A bigger sample size is also required in future research to ensure that the population is adequately represented. This study also needed to be expanded in terms of time, published literature, and location. Due to the paucity of available literature, additional studies are needed to examine the impact of TPS-FC model. Because the study was limited to a single university, it is impossible to extrapolate the results to other sister institutions. However, future studies should use mixed-methods to extend to access data from different sources to test the effect of the proposed TPS-FC model or otherwise. Future studies should involve public and private universities to broaden the use of the suggested TPS-FC model. It can be used in language, art, or social science classes to comprehend how the proposed TPS-FC model would affect the other disciplines. Future research should consider well-designed pre-class activities for the FC model, as this study goes to great lengths to overcome the difficulties of FC model (particularly during in-class period).

CONCLUSIONS

Due to the students' poor learning achievement and ICT self-efficacy, the teacher educators were challenged to look for alternative teaching methods. FC model is one of the promising teaching methods currently employed by institutions and individual teachers. This study found that TPS-FC model improved students' learning achievement and ICT self-efficacy. Results showed that TPS-FC model was more effective than the conventional flipped classroom model. TPS-FCM helped the students to think individually about the topic, engage in group discussions, and share their ideas. Gender equity can be achieved if TPS-FC model is appropriately implemented, especially in students' ICT self-efficacy.

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