International Journal of Evaluation and Research in Education (IJERE)
Vol. 15, No. 1, February 2026, pp. 616~625
ISSN: 2252-8822, DOI: 10.11591/ijere.v15i1.31880

Perceptions and attitudes of postgraduate students toward the flipped classroom model: case study at Vinh University, Vietnam

Huong Thi Nguyen[1], Le Van Vinh[2], Thai Thi Hong Lam[3], Nhi Thi Nguyen[4]
[1]Faculty of Social Sciences and Arts, Saigon University, Ho Chi Minh City, Vietnam
[2]Faculty of Physics, Vinh University, Vinh City, Vietnam
[3]Faculty of Mathematics, Vinh University, Vinh City, Vietnam
[4]Faculty of Natural Science Education, Saigon University, Ho Chi Minh City, Vietnam

Article Info

Article history:

Received Sep 6, 2024
Revised Dec 2, 2025
Accepted Dec 11, 2025

Keywords:

Attitudes
Flipped classroom
Flipped learning
Perceptions
Postgraduate students
Teacher training

ABSTRACT

Teaching using the flipped classroom model (FCM) is one of the methods of organizing teaching that combines (blended learning) electronic learning methods (e-learning) with traditional teaching and learning methods. The research aims to understand the perceptions and attitudes of postgraduate students at Vinh University towards the flipped classroom and analyze the benefits and difficulties that students encounter. When teaching according to FCM, thereby proposing solutions to improve efficiency when teaching according to this model. The research was conducted using a combination of qualitative and quantitative methods. Quantitative data were obtained from the participation of 121 postgraduate students in teacher training. Qualitative data was taken from the interview results of seven students who experienced the flipped classroom. Results from the survey show that the majority of students have a positive attitude toward learning in the FCM. Research also shows that the FCM positively impacts students' attitudes toward the course through the benefits it brings. Students participating in the survey also shared the difficulties they encountered when studying in the FCM and gave some suggestions to improve the effectiveness of applying this model in the future.

Corresponding Author:

Nhi Thi Nguyen
Faculty of Natural Science Education, Saigon University
273 An Duong Vuong street, Ho Chi Minh City, Vietnam
Email: ntnhi@sgu.edu.vn

1. INTRODUCTION

Flipped classroom is a teaching method by "reversing" traditional teaching methods to attract learners into the learning process, which has many advantages in online teaching and learning. According to previous studies [1], [2], the effectiveness of using a flipped classroom will encourage different learning styles. Yıldız *et al.* [3] also believe that this model helps learners build confidence and responsibility for learning, so it should be included in various courses. In a flipped learning environment, there are many reasonable advantages to organize teaching as well as how to transmit knowledge. This is especially important for lectures who combine traditional and online instruction. The use of technology allows lectures to be delivered online to free up class time, increase interaction and collaboration, and promote more interaction between learners and lecturers, especially when live chat is more interactive [4]. This model helps learners be flexible in learning so lessons will become more interesting [5]. Besides the benefits, flipped learning environments also have many challenges, such as problems with students' internet access, poor or

slow internet connections, and lack of communication between lectures and students in classes [6]. However, the flipped model is still an effective method, considered as a viable alternative to traditional classroom learning [7].

Research and exploration of the flipped classroom model (FCM) have garnered significant attention. Many authors have studied and proposed organizing activities within the FCM using various approaches, such as creating blended learning environments [8], integrating project-based learning with the FCM [9], and combining face-to-face and online teaching in the flipped classroom [10]. However, the effectiveness of teaching organization still depends heavily on learners' characteristics, available infrastructure, and local cultural factors. Therefore, understanding learners' opinions about each form of teaching organization (including FCM) is essential to devising appropriate solutions for utilizing teaching models, aiming to achieve high effectiveness in teaching organization. This study was conducted with the aim of understanding students' perceptions and attitudes about applying FCM in teaching, and also recording the benefits and difficulties they encountered when participating in the flipped classroom, thereby proposing solutions to improve the effectiveness of FCM. This research focuses on finding answers to the following questions:

- What are students' perceptions and attitudes toward using FCM?
- What are the benefits of FCM that students perceive?
- What difficulties do students encounter when learning FCM and what suggestions do they have to improve the effectiveness of FCM?

2. LITERATURE REVIEW

Flipped classroom or flipped learning, two terms used interchangeably, refer to a teaching model as opposed to the conventional classroom [11], [12]. FCM is defined as a teaching model that promotes thinking in and out of the classroom through the idea that schoolwork and homework are interchangeable. The FCM is a teaching model in which students learn basic subject knowledge before coming to class, then come to class to have active learning experiences [4], [13]. FCM is an element of blended learning that integrates both face-to-face learning in class through group discussions and distance learning outside the classroom by watching asynchronous video lessons and collaborating online [14], [15].

The fundamental difference between traditional and flipped classrooms is the implementation of cognitive levels of learners in the direct classroom and outside the classroom. The design of a traditional classroom follows Bloom's Taxonomy, in which the areas of memory and understanding are worked on in class and the next four levels take place at home [16], [17]. On the other hand, the flipped classroom reverses this taxonomy, where the areas of memorization and understanding are done at home [18], [19]. We summarize this with the comparison between traditional and flipped classrooms, as presented in Table 1.

Table 1. Comparison between traditional and flipped classrooms

Thinking level	Traditional classroom	Flipped classroom
Remembering	Face to face lecture	Pre-recorded lectures, read material and watch video lectures at home, outside of class.
Understanding	Question and answer	Do tasks, discuss and collaborate with friends at home, outside of class.
Applying	Homework	Classroom activities such as a group discussion.
Analyzing	Homework	Classroom activities such as group discussions. Student projects, presentations, peer evaluation, instructor evaluation. Do in class.
Evaluating	Homework or nothing	Classroom activities such as group discussions. Student projects, presentations, peer evaluation, instructor evaluation. Do in class.
Creating	Homework or nothing	Classroom activities such as group discussions. Student projects, presentations, peer evaluation, instructor evaluation. Do in class.

3. METHOD

3.1. Research type

This research was conducted using a mixed method of qualitative and quantitative research (mixed methods research). According to Cohen *et al.* [20], this research method helps researchers investigate the issues they are interested in comprehensively and deeply; combining both qualitative and quantitative data sources will help promote the strengths of each side while limiting the weaknesses that each type of data may have. In the current study, quantitative research was conducted to examine students' perceptions and attitudes toward the flipped classroom they attended. A quantitative design is appropriate because the first research question is answered by measuring students' attitudes and presenting the results numerically (average score). Meanwhile, a qualitative design was used to answer the second and third research questions, which emphasizes exploring students' experiences in the flipped classroom. Given the importance of both types of data, the current study used a mixed methods design.

3.2. Sample

Stratified random sampling was used to select subjects. Sampling is done by researchers with the aim of obtaining a representative sample of the population. The total sample in this study is 121 postgraduate students in the teacher training course at Vinh University. This is consistent with the results in previous studies [18], [19], which stated that the appropriate sample size in a study is between 30 and 500. The survey time was the second semester of the 2022-2023 year. Of the 121 students participating in the quantitative study, seven of them were invited to participate in focus group interviews. Focus group interview participants were purposively selected based on their active participation and good performance in their studies. Given these criteria, selected participants must be able to share their experiences in detail as they participated in flipped classroom activities. The total was 121 students with the characteristics shown in Table 2.

Table 2. Participants

Variable		Frequency	Percentage (%)
Gender	Female	82	67.77
	Male	39	32.23
Age (years)	25 to 30	92	76.03
	30-40	27	22.31
	More than 40	2	1.66
Work experience (years)	0 to 5	43	35.54
	5 to 10	40	33.06
	More than 10	38	31.40

3.3. Didactic intervention

Implementation of the FCM was carried out over a period of 15 weeks. The planning and implementation of teaching is based on three phases of flipped learning: the teacher prepares digital resources (videos, student tasks, and Power Point presentations) for students to preview. For face-to-face meetings held every 2 weeks, students will asked questions or concerns about the consulted documents. Then, a case-based activity was given for the groups to work on to solve with the guidance of the instructor; and finally ends in the third stage with an assessment to determine the level of understanding of each subject.

3.4. Instrument

The research tool used is a survey developed and classified based on the results of previous study on flipped classroom implementation [21]. The questionnaire includes two parts. Part 1 includes personal information. Part 2 includes 22 questions to determine the degree of agreement or disagreement of students with statements related to the FCM. The scale is established for each Likert-type item with 5 points for the student satisfaction (completely disagree to completely agree). Validation of the content of the tool was carried out using evaluation techniques by two experts who are university lecturers and piloted with five students to determine the wording and orientation of each item related to the postgraduate-level FCM. After this stage, checking the reliability of the tools resulted in Cronbach's alpha (α)=0.919, corrected item–total correlation of each observed variable was greater than 0.3, meaning that this tool is reliable [20]. The second tool is focus group interviews. Selected participants were asked to share their views and experiences on the benefits and difficulties of the FCM they participated in and suggestions for improving the effectiveness of FCM. The interview was recorded with the participant's consent.

3.5. Data collection and data analysis

After finishing the FCM course, the researcher distributed questionnaires to the students participating in the course. The researcher then contacted seven selected participants to participate in a focus group interview. When conducting focus group interviews, participants are first given a form with questions written. Participants were then asked to answer those questions. They take turns answering questions based on the experiences they had in the flipped classroom. They were also allowed to add to or refute other participants' answers as long as they recounted what they experienced and felt during their participation in the flipped classroom. Before the focus group interview ended, when the researcher noticed interesting or unsatisfactory answers, the researcher asked the participants to elaborate further to enrich the data. The focus group interview was conducted with two main questions and recorded for 30-40 minutes for the whole group.

The data obtained were analyzed using SPSS with version 27 to calculate the mean (M) and standard deviation (SD) of each item so that the results could be interpreted. Findings were interpreted based on the range of explanatory criteria. A mean point from 1.00 to 2.50 indicates a negative attitude while a point from 2.51 to 5.00 indicates a positive attitude.

Data from the focus group interviews were analyzed qualitatively through several steps according to Creswell and Creswell [22]. First, the data are organized and prepared for analysis. In this step, the focus group interview was recorded. The researcher then recorded general information and thoughts obtained from the interview. Data from the interviews were coded to find the group's main themes. Finally, the themes and descriptions of each theme were presented.

4. RESULTS AND DISCUSSION

4.1. For question number 1

Regarding students' awareness and attitudes towards implementing learning according to the FCM, we summarize the survey results, as shown in Table 3. Accordingly, 121 learners answered 22 questions in the questionnaire (according to the Likert scale). Then, we used SPSS software to perform statistical analyses with the obtained data set.

In the survey listed in Table 3, the average values of statements 1 to 22 do not differ much and are all within the range of 3 to 5 on a 5-point scale (of which completely agree is 5.00 and strongly disagree is 1.00). This shows that students quite agree with all the comments in the survey, which are all positive comments about the flipped classroom. The highest mean scores available were in items 13, 12, 19, and 22 (M=4.15 and 4.14), through which students conveyed that: i) during the flipped learning lesson, the learner understood deeper lesson content; ii) learning according to FCM helps learners adjust their learning speed to suit their own level; and iii) participating in FCM classroom activities helps learners consolidate the content they have learned. In the future, FCM may be a suitable teaching strategy. The overall average score of the 22 items in the questionnaire is 4.0548, as shown in Table 4. The overall average score of the questionnaire was much higher than 3.00 indicating that learners had a positive attitude towards the flipped learning in which they were involved. To see whether positive attitudes reach statistical significance, the one-sample t-test table had to be consulted, as shown in Table 5.

Table 3. Students' awareness and attitudes toward implementing learning using the FCM

Survey aspects	Totally agree	Agree	Undecided	Disagree	Totally disagree	M	SD
Previewing the lectures at home helps me better grasp the main content of each week's lessons.	7	102	7	4	1	4.07	0.412
I can review the lesson content any time I need.	0	98	12	10	1	4.06	0.394
I have learned a lot from online learning materials	2	95	18	5	1	3.99	0.353
The study strategies I apply are more effective because I have more time in class	6	94	15	4	2	4.03	0.340
Class time is used effectively	10	93	8	9	1	4.07	0.369
I have more time to practice skills in class.	16	89	10	6	0	4.16	0.408
I have more opportunities to discuss with teachers and classmates about issues related to lessons.	5	96	14	4	2	4.03	0.364
Learning FCM helps me feel more comfortable in exchanging my opinions in class	6	94	15	4	2	4.02	0.353
In FCM class, I interact more with my classmates.	0	98	12	10	1	3.93	0.309
With FCM, I feel more confident with my studies.	21	80	14	5	1	4.12	0.432
I am more proactive in my learning with FCM	0	101	10	9	1	3.96	0.271
Studying according to FCM helps me adjust my learning speed to suit my level	16	89	10	6	0	4.14	0.394
During a flipped learning session, learners have a deeper understanding of the lesson content	16	89	14	2	0	4.15	0.441
Comments from teachers and classmates help me improve my learning results right in class	7	102	7	4	1	4.07	0.293
Learning in FCM has reduced learners' dependence on lecturers	0	98	12	10	1	3.94	0.324
With FCM, teachers provide me with many rich learning resources on the internet.	1	96	18	5	1	3.96	0.327
The online resources provided by teachers are very helpful for me in learning related skills	5	95	15	4	2	4.01	0.329
Compared to other classes, in FCM class I find myself participating more in class activities.	10	93	8	9	1	4.06	0.372
Participating in FCM class activities helps me consolidate the content I have learned.	16	89	10	6	0	4.14	0.394
Compared to traditional classes, FCM is more engaging and interesting	12	89	14	5	1	4.11	0.383
Learning activities in FCM require more time and effort from learners than usual	21	80	14	5	1	4.03	0.364
In the future, FCM may be a suitable teaching strategy	48	58	9	5	1	4.14	0.434

Table 4. Descriptive statistics of learners' attitude scores

Variable	N	M	SD	Std. error mean
Attitude	22	4.0548	0.22452	0.02041

Table 5. One-sample t-test results for the learners' attitude scores

Variable	Test value=0					
	t	df	Sig (2-tailed)	Mean difference	95% confidence interval of the difference	
					Lower	Upper
Attitude	198.658	120	0.000	4.05485	4.0144	4.0953

It can be seen in Table 5, the learners' attitude is significantly positive, as the p-value is less than the significance level ($p<0.05$). Learner feedback shows that they appreciate the quality of out-of-class and in-class activities because these activities help them increase their understanding of basic knowledge before and during class, increasing their time for course, enhancing self-study. Learners demonstrated positive attitudes toward FCM implementation. This finding is significant because learners with positive attitudes toward learning tend to have better performance. This result is consistent with previous studies [23], [24], who found that the flipped classroom has a positive impact on students' attitudes and learning outcomes [25].

Another result of this study is that the flipped classroom increased student participation in the classroom, increasing the level of student interaction with the instructor. Surveyed students suggested that FCM-based courses increased their interest in the course and made them more active in the lessons in this study. This result is also consistent with previous studies [5], [26], [27]. They also stated that flipped learning is effective in increasing students' engagement in study environment [26], [28]–[30].

4.2. For question number 2

4.2.1. About the benefits of FCM

Based on the focus group interviews, there are several benefits of FCM learning from the student's perspective. The benefits can be classified into six main themes, including: i) learners' absorption of lesson content; ii) use of class time; iii) level of learner interaction; iv) the role of the learner in the learning process; v) learning materials; and vi) learner participation in classroom activities. The findings of each theme will be discussed along with interview excerpts from the participants. To maintain the confidentiality of the participants, pseudonyms were used when presenting the excerpts.

4.2.2. About learners' absorption of lesson content

Participants said that when participating in a flipped classroom, absorbing lesson content was more effective than in a traditional classroom. Participant 1 said:

> "*I prefer to study the lectures that the lecturer provides at home before going to class rather than listening to lectures in class in the traditional way. I can proactively study at any time before class from many different information sources*."

Participant 3 added that:

> "*In terms of understanding the theoretical content of the lesson communicated by the teacher through lectures, videos and internet resources shared on the studying management system in FCM, I can master the lesson content better when studying with this method*."

4.2.3. About using class time

Most responses said that FCM helps use class time more effectively. Participants 4 and 7 stated:

> "*Instead of having to spend a lot of time listening to the lecturer lecture and taking notes, learners have more time to consolidate the knowledge they have learned from lectures at home through practice activities*."
> "*In FCM, learners have more time to interact with each other, interacting with lecturers helps develop their collaborative communication capacity and other core competencies are also have more development opportunities*."

4.2.4. About the level of learner interaction

The respondents all said that they had more opportunities to contact and discuss with lecturers about issues related to lecture content. Participants 6 and 3 explained:

> "*I interact more with my classmates during classes. I also feel more comfortable in exchanging my opinions in class without feeling shy and embarrassed like before*."
> "*In FCM, I have more opportunities to discuss with lecturers and classmates about issues related to lessons*."

The increase in the level of interaction between learners and teachers and between learners and learners can be explained by the fact that teachers and students have more time to share than in the traditional learning style when the majority the time the teacher has to lecture and the students have to listen attentively and take notes.

4.2.5. About the role of learners in the learning process

Interview respondents said that studying according to FCM helps them be more proactive in learning. The initiative can be proactively choosing the time, place and method of receiving the content of the lectures provided by the teacher. At the same time, initiative also means the learner's sense of self-discipline and responsibility for their own learning. Participants 1 and 7 said:

> "*Studying under FCM has helped me learn according to my own level and abilities. I can adjust the speed of absorbing the theoretical foundation to suit my abilities. Therefore, I feel more confident when studying according to FCM*."
> "*If learning in the traditional style, when the teacher lectures in class, all learners in the class must try to grasp the content that the teacher conveys at the same speed and in the same time. a period of time regardless of their level. This reality causes many weak learners to face many difficulties when they cannot keep up with other students in class and cannot master what the lecturer wants to convey*."

Participant 2 shared more, "*thanks to taking an active role in the learning process and adjusting my learning to suit my own abilities, I feel more confident with my learning*."

4.2.6. About learning materials

Participants said that FCM gave them the opportunity to access many rich learning resources on the internet through teachers. They evaluated that these resources were helpful to them in developing core competencies. Learning resources that teachers provide before each class in the form of PowerPoint presentations, tutorial videos on YouTube, and links to websites containing related content lessons and practice exercises have helped learners access different sources of knowledge related to each lesson they learn every week. This rich and diverse source of materials has contributed to providing students with a solid theoretical foundation that they can apply to lessons and practice, thereby developing their core competencies. However, there are still opinions that are not really satisfied with the resources that instructors provide on the learning management system for each lesson. This shows that learners' need to access other resources and in other ways should be further considered by instructors.

Thus, feedback also points out the advantages of this model in terms of a rich learning material system as well as the level of interaction with classmates, helping to improve learning efficiency. Before coming to class, learners have carefully prepared the subject materials, so during class, they actively participate in group discussions. Thereby, student satisfaction and learning experience are significantly enhanced.

4.2.7. About learner participation in classroom activities

Interview participants said they had more opportunities to participate in classroom activities organized by instructors such as working in pairs, groups, and contributing ideas. Participant 6 said that:

> "*Participating in these activities helps me reinforce the content they have previously learned at home, thanks to which I can better grasp the lesson content*."

Besides positive opinions about the opportunity to participate in class activities and the benefits of this participation for learning, there is still an opinion that is not really satisfied with this. This shows that although teachers organize activities in class and encourage learners to participate, these activities may not be attractive to a portion of the learners in the class and do not really have a positive impact towards their

learning. Therefore, lecturers also need to research to choose truly attractive and meaningful activities to organize classroom teaching. In the classroom, learners can work in groups, students have the opportunity to participate with other students and they can learn a lot of knowledge from their friends. Therefore, students' learning efficiency and results have improved. The results are consistent with other studies that examined the effectiveness of flipped learning environments [30], which increase student satisfaction [31], [32]. Thanks to pre-prepared lectures or lessons at home, students can access knowledge almost anytime, anywhere and increase their motivation to participate in lessons [9]. Students also reported that this learner-centered learning model can lead to improved learning outcomes. Besides, flipped learning can also help them better remember what they have learned and understood. This is consistent with the conclusions of study conducted by Chen *et al.* [28]. They argue that FCM helps active learning lead to successful learning outcomes. Furthermore, learners are satisfied with this model because it provides active learning, effective use of time in the classroom, self-paced learning, and watching videos whenever they want.

4.3. For question number 3

4.3.1. The difficulties that students discover in learning FCM and suggestions to improve the effectiveness of FCM

In the questionnaire sent to students, they were asked to answer two open-ended questions related to the difficulties they encountered when studying according to FCM and based on those difficulties, make some recommendations to help applying FCM more effective. Students' responses to the two questions are compiled and summarized:

i) Difficulties students encounter when studying according to FCM

- Not familiar with the new learning method: many students said that they are used to the traditional learning style where a lecturer lectures in class and then do homework, so when learning in the FCM they are still quite confused. Some students shared that because they were not familiar with the new learning method, they sometimes forgot to log in to the learning management system to preview the lecture before going to class.
- Lack of concentration when self-studying: a few students participating in the survey also pointed out that one of the difficulties they encountered when having to self-study lecture content at home was lack of concentration. Some students said that because there was no one around to remind them, they were easily distracted by surrounding factors, especially other interests on the internet such as social networks or entertainment. This makes it difficult for them to concentrate on the lecture content, so it often takes them a lot of time to view all the content provided by the lecturer.
- Lack of self- discipline: if in the past, students mainly relied on lecturers' classroom lectures to acquire background knowledge related to different writing genres, with the FCM, students must form their own learning habits independently and rely on themselves. Because of this, many students say they are still not ready and lack the spirit of self-discipline and initiative in learning outside of the classroom.
- Lack of support outside the classroom: self-study without the support of a lecturer is also one of the difficulties for many students in the beginning of studying under FCM, especially for students whose ability to absorb is still slow. Some students said that during the process of studying documents at home, there were some points they did not understand clearly but did not have a lecturer or classmates nearby to discuss and seek timely help.
- The large amount of work that needs to be done: another difficulty that some students mentioned in their responses related to the large amount of lessons they had to study at home. When studying under FCM, students not only have to work more outside of class but in class, they also have to be more active because instructors have more time to organize different activities. Because the workload has increased, many students feel tired and stressed.
- Some lectures lack appeal: some students think that there are still lectures that lecturers prepare in the form of PowerPoint presentations that are quite boring and require them to spend a lot of time watching and re-watching to be able to grasp the content that the lecturers want to convey. Besides, watching many lectures like this throughout the semester also causes boredom for students.
- Technology infrastructure: many students reported that they had difficulty logging in to the school's Moodle site, especially unsecured connection problems that took them a long time to log in successfully. Many students also cannot log in to preview lectures because they forgot their password or their internet connection speed is slow. In addition, some students think that the interface of the Moodle site is quite boring, so it does not stimulate their interest in learning.

Research shows that learners prefer flipped learning, however there are some challenges they face, such as lack of interaction with instructors outside of class, time consuming, and workload. Many lectures lack appeal, slow internet connection, and lack of computer equipment. These findings are consistent with the

difficulties learners are experiencing in study [31], [32]. They mentioned that in poor areas, learners may not have access to computers and internet that FCM required [24], [31].

ii) Suggestions to improve the efficiency of applying FCM

Firstly, to help students better adapt to FCM, lecturers need to provide clear, easy-to-understand instructions from the beginning of the semester about the requirements for activities students need to do at home. At the same time, to reduce the pressure of work students need to do outside of class, instructors can limit the amount of lesson content that students are required to view to understand the basic content of each weekly lesson. Other resources can be self-selected and students are encouraged to read more if they have time or if they feel it is necessary. Secondly, to promote students' self-study spirit and responsibility for self-studying lectures at home, lecturers need to have reasonable incentive policies to motivate students. Some students suggested that self-study at home should also have specific criteria for evaluating self-study results and be announced to students.

Thirdly, to make the lectures more attractive and engaging for students to stimulate their interest in learning, many comments said that instead of preparing lectures on PowerPoint, lecturers should make video more interactive. In addition, students also suggested that lecturers can take advantage of social networks to increase the effectiveness of lectures by sharing them on Facebook or YouTube so that students can both watch and leave comment if they do not understand something. Fourthly, many students suggested that lecturers should petition the school to upgrade the learning management system (LMS) page to an updated version so that logging in takes less time and at the same time change the course interface to make it lively and more creative. When having trouble logging in or other issues related to online learning, students also hope to receive timely support from lecturers and the department in charge of the information technology system of the school. In addition, many students wish to have more computers connected to the internet equipped on campus and hope that the school's Wi-Fi network is strong and stable enough to keep their studies uninterrupted.

5. CONCLUSION

The results obtained from the questionnaire and interviews show that FCM is an effective teaching strategy used at Vinh University, suitable for the needs of learners at the graduate level, develop their higher-order thinking and problem-solving skills. The attitudes of most surveyed practitioners were very positive, they found the model attractive and interesting because it makes a real difference. Additionally, students who participated in diverse class activities in a flipped learning environment competed, learned and worked more actively with others during group discussions. Therefore, thanks to classroom activities, students find that they become more active and energetic in the flipped learning environment. In addition, learners see themselves as protagonists in their own learning process, they play an active, autonomous and collaborative role from the beginning, so they can learn a lot from online learning materials because this model provides diverse support, allowing them to have more time to study materials. To effectively implement FCM teaching strategies, there needs to be specific research on each subject in applying FCM in the future.

FUNDING INFORMATION

No external funding was received for this study.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Huong Thi Nguyen		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Le Van Vinh	✓	✓			✓	✓	✓	✓	✓	✓		✓	✓	✓
Thai Thi Hong Lam		✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓
Nhi Thi Nguyen	✓	✓			✓	✓	✓	✓	✓	✓		✓	✓	✓

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare no competing interests.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [NTN], upon reasonable request.

REFERENCES

[1] J. Bergmann and A. Sams, *Flip your classroom: reach every student in every class every day*. Washington, DC: International Society for Technology in Education (ISTE), 2012.

[2] K. K. Molnar, "What effect does flipping the classroom have on undergraduate student perceptions and grades?" *Education and Information Technologies*, vol. 22, no. 6, pp. 2741–2765, Nov. 2017, doi: 10.1007/s10639-016-9568-8.

[3] E. Yıldız, U. Doğan, Ö. Özbay, and S. S. Seferoğlu, "Flipped classroom in higher education: an investigation of instructor perceptions through the lens of TPACK," *Education and Information Technologies*, vol. 27, no. 8, pp. 10757–10783, Sep. 2022, doi: 10.1007/s10639-022-11059-8.

[4] T. Long, J. Cummins, and M. Waugh, "Use of the flipped classroom instructional model in higher education: instructors' perspectives," *Journal of Computing in Higher Education*, vol. 29, no. 2, pp. 179–200, Aug. 2017, doi: 10.1007/s12528-016-9119-8.

[5] Y. Wang, X. Huang, C. D. Schunn, Y. Zou, and W. Ai, "Redesigning flipped classrooms: a learning model and its effects on student perceptions," *Higher Education*, vol. 78, no. 4, pp. 711–728, Sep. 2019, doi: 10.1007/s10734-019-00366-8.

[6] M. C. Ruiz-Jiménez, R. Martínez-Jiménez, and A. Licerán-Gutiérrez, "Students' perceptions of their learning outcomes in a flipped classroom environment," *Educational Technology Research and Development*, vol. 72, no. 2, pp. 1205–1223, Apr. 2024, doi: 10.1007/s11423-023-10289-y.

[7] D. González-Gómez and J. S. Jeong, "The flipped learning model in general science: effects on students' learning outcomes and affective dimensions," in *Active Learning in College Science: The Case for Evidence-Based Practice*, J. J. Mintzes and E. M. Walter, Eds., Cham: Springer International Publishing, 2020, pp. 541–549, doi: 10.1007/978-3-030-33600-4_33.

[8] J. Bishop and M. Verleger, "The flipped classroom: a survey of the research," in *2013 ASEE Annual Conference & Exposition Proceedings*, 2013, pp. 1–18, doi: 10.18260/1-2--22585.

[9] N. T. Thành and N. T. Dũng, "Project-based learning with the flipped classroom model in B-learning," (in Vietnamese), *Tạp chí Khoa học, Trường Đại học Sư phạm Hà Nội*, vol. 60, pp. 222–230, 2015. [Online]. Available: https://tailieunhanh.com/vn/tlID1375149_day-hoc-theo-du-an-voi-mo-hinh-lop-hoc-dao-nguoc-trong-blearning.html

[10] M. J. Lage, G. J. Platt, and M. Treglia, "Inverting the classroom: a gateway to creating an inclusive learning environment," *The Journal of Economic Education*, vol. 31, no. 1, pp. 30–43, Jan. 2000, doi: 10.1080/00220480009596759.

[11] G. Aşıksoy and F. Özdamlı, "Flipped classroom adapted to the ARCS model of motivation and applied to a physics course," *EURASIA Journal of Mathematics, Science and Technology Education*, vol. 12, no. 6, pp. 1589–1603, Jul. 2016, doi: 10.12973/eurasia.2016.1251a.

[12] M. Buil-Fabregá, M. Martínez Casanovas, N. Ruiz-Munzón, and W. L. Filho, "Flipped classroom as an active learning methodology in sustainable development curricula," *Sustainability*, vol. 11, no. 17, p. 4577, Aug. 2019, doi: 10.3390/su11174577.

[13] M. B. Gilboy, S. Heinerichs, and G. Pazzaglia, "Enhancing student engagement using the flipped classroom," *Journal of Nutrition Education and Behavior*, vol. 47, no. 1, pp. 109–114, Jan. 2015, doi: 10.1016/j.jneb.2014.08.008.

[14] D. Saglam and A. Arslan, "The effect of flipped classroom on the academic achievement and attitude of higher education students," *World Journal of Education*, vol. 8, no. 4, pp. 170–176, Aug. 2018, doi: 10.5430/wje.v8n4p170.

[15] F. S. Yildirim and S. A. Kiray, "Flipped classroom model in education," in *Research Highlights in Education and Science*, W. Wu, S. Alan, and M. T. Hebebci, Eds., Ames, IA: ISRES Publishing, 2016, pp. 1–8.

[16] J. Cabero-Almenara, R. Romero-Tena, C. Llorente-Cejudo, and A. Palacios-Rodríguez, "Academic performance and technology acceptance model (TAM) through a flipped classroom experience: training of future teachers of primary education," *Contemporary Educational Technology*, vol. 13, no. 3, p. ep305, May 2021, doi: 10.30935/cedtech/10874.

[17] J. P. Vitta and A. H. Al-Hoorie, "The flipped classroom in second language learning: a meta-analysis," *Language Teaching Research*, vol. 27, no. 5, pp. 1268–1292, Sep. 2023, doi: 10.1177/1362168820981403.

[18] R. Vaezi, A. Afghari, and A. Lotfi, "Flipped teaching: Iranian students' and teachers' perceptions," *Applied Research on English Language*, vol. 8, no. 1, pp. 139–164, 2019.

[19] Saira, F. Ajmal, and M. Hafeez, "Critical review on flipped classroom model versus traditional lecture method," *International Journal of Education and Practice*, vol. 9, no. 1, pp. 128–140, 2021, doi: 10.18488/journal.61.2021.91.128.140.

[20] L. Cohen, L. Manion, and K. Morrison, "Experiments, quasi-experiments, single-case research and meta-analysis," in *Research Methods in Education*, 6th ed., L. Cohen, L. Manion, and K. Morrison, Eds., London: Routledge, 2007, pp. 290–314.

[21] Z. Zainuddin, "Students' learning performance and perceived motivation in gamified flipped-class instruction," *Computers & Education*, vol. 126, pp. 75–88, Nov. 2018, doi: 10.1016/j.compedu.2018.07.003.

[22] J. W. Creswell and J. D. Creswell, *Research design: qualitative, quantitative, and mixed methods approaches*, 3rd ed. Thousand Oaks, CA: SAGE Publications, Inc., 2009.

[23] F.-D. Fernández-Martín, J.-M. Romero-Rodríguez, G. Gómez-García, and M. R. Navas-Parejo, "Impact of the flipped classroom method in the mathematical area: a systematic review," *Mathematics*, vol. 8, no. 12, p. 2162, Dec. 2020, doi: 10.3390/math8122162.

[24] A. A. Rahman, B. Aris, H. Mohamed, and N. M. Zaid, "The influences of flipped classroom: a meta analysis," in *2014 IEEE 6th Conference on Engineering Education (ICEED)*, Dec. 2014, pp. 24–28, doi: 10.1109/ICEED.2014.7194682.

[25] A. A. Hall and D. D. DuFrene, "Best practices for launching a flipped classroom," *Business and Professional Communication Quarterly*, vol. 79, no. 2, pp. 234–242, Jun. 2016, doi: 10.1177/2329490615606733.

[26] L. Altemueller and C. Lindquist, "Flipped classroom instruction for inclusive learning," *British Journal of Special Education*, vol. 44, no. 3, pp. 341–358, Sep. 2017, doi: 10.1111/1467-8578.12177.

[27] Ö. Özbay and S. Çınar, "Effectiveness of flipped classroom teaching models in nursing education: a systematic review," *Nurse Education Today*, vol. 102, p. 104922, Jul. 2021, doi: 10.1016/j.nedt.2021.104922.

[28] K. Chen *et al.*, "Academic outcomes of flipped classroom learning: a meta-analysis," *Medical Education*, vol. 52, no. 9, pp. 910–924, Sep. 2018, doi: 10.1111/medu.13616.
[29] E. Colomo-Magaña, R. Soto-Varela, J. Ruiz-Palmero, and M. Gómez-García, "University students' perception of the usefulness of the flipped classroom methodology," *Education Sciences*, vol. 10, no. 10, p. 275, Oct. 2020, doi: 10.3390/educsci10100275.
[30] Y. Doğan, V. Batdı, and M. D. Yaşar, "Effectiveness of flipped classroom practices in teaching of science: a mixed research synthesis," *Research in Science & Technological Education*, vol. 41, no. 1, pp. 393–421, Jan. 2023, doi: 10.1080/02635143.2021.1909553.
[31] G. Akçayır and M. Akçayır, "The flipped classroom: a review of its advantages and challenges," *Computers & Education*, vol. 126, pp. 334–345, Nov. 2018, doi: 10.1016/j.compedu.2018.07.021.
[32] M. Ramirez, "In-class flip: flipping a literature class for student-centered learning," in *Innovations in Flipping the Language Classroom: Theories and Practices*, J. Mehring and A. Leis, Eds., Singapore: Springer Singapore, 2018, pp. 93–103, doi: 10.1007/978-981-10-6968-0_7.

BIOGRAPHIES OF AUTHORS

Huong Thi Nguyen received her Ph.D. at Vietnam Academy of Social Sciences, Viet Nam. She is currently a senior lecturer and educational researcher at Saigon University. She has taken part in various professional development activities for teachers and published several articles on qualified international journals and conferences. Her research field includes history, educational management, and higher education. She can be contacted at email: nthuong1977@sgu.edu.vn; huongnt@vinhuni.edu.vn.

Le Van Vinh received the Ph.D. degree in scientific education, from the Vinh University. He is currently a lecturer and educational researcher at Vinh University. He has taken part in various professional development activities for teachers and published several articles on qualified international journals and conferences. His research field includes physics education, education management, higher education, STEM education, and teacher training. He can be contacted at email: levanvinhdhv@gmail.com.

Thai Thi Hong Lam received her Ph.D. in science education from Vinh University, Vietnam. She has accumulated a lot of experience as a lecturer and researcher in the field of educational training. She is currently a lecturer at Vinh University, Vietnam. Her research interest includes mathematics education, higher education, STEM education, teacher training, teaching methods, and harnessing information technology in education and science. She can be contacted at email: lamdhv123@gmail.com.

Nhi Thi Nguyen received the Ph.D. degree in scientific education, from the Vinh University, Vietnam. She has acquired enormous working experiences as a lecturer and a researcher in teacher training. She is currently a senior lecturer with the Vinh University, Vietnam. She has published several research papers in prestigious international journals and conference proceedings. Her research interests span a broad range of interesting topics, including physics education, education management, higher education, STEM education, teacher training, teaching methods, and exploiting information technology in education and science. She can be contacted at email: ntnhi@sgu.edu.vn; hongnhi1076@gmail.com.