WHAT FACTORS MOST INFLUENCE STUDENT LEARNING OUTCOMES WHEN USING THE FLIPPED CLASSROOM MODEL?

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ABSTRACT: The article studies the learning effectiveness of students when acquiring knowledge according to the flipped classroom model (FCM). Participants in this study were 305 students from the Faculty of Electrical Technology at Industrial University of Ho Chi Minh City (IUH). The research design is qualitative descriptive with answering 32 questions from a Likert scale with 5 levels. The author used qualitative and quantitative analysis and regression methods to produce research results with 07 factors affecting the learning efficiency of students with the intention of using FCM. The difference of this study compared to previous studies is to explore the impact of factors on student learning efficiency when studying according to the FCM method for students majoring in electrical technology. From there, lecturers find solutions to teach according to the model more effectively.

Keywords: Flipped classroom model, teaching methods, teaching, self- study

1. INTRODUCTION

During the 4.0 industrial revolution, educational training goals require lecturers (teachers) to find ways and methods to support students in developing skills such as interaction and collaborative learning. , how to improve individual learning capacity in learning and teaching to promote positivity, initiative, and creativity in students ... One of the solutions of lecturers is to innovate the teaching model . The form of teaching is also called the teaching method. Through teaching models that meet the needs of the times, it will help students develop their creative, experiential and professional abilities.

For today's university students, self-study plays a particularly important role. However, in reality, students have not really done well in their self-study task. According to Ngo Tu Thanh and Nguyen Quoc Vu (2019), teaching is teaching students how to self-study to turn information into knowledge. Therefore, teaching students how to study, focusing on teaching how to self-study to promote students' internal strength in the learning and research process, is an extremely important and urgent issue in current university training.

In the current university training program under the credit system, the engineering sector in general and the Faculty of Electrical Engineering in particular, the self-study part of each subject usually accounts for twice the number of credits of that subject. Thereby, it can be seen that students' self-study and self-research are included in the content and duration of the program; the time for theoretical study and classroom study is reduced, which will reduce the knowledge transfer of teachers; the time for students' self-study and self-research is increased to promote their initiative and creativity.

The flipped classroom model is considered an alternative method that combines education with technological advances (L. R. Murillo-Zamorano et al., 2019). Previously, there have been many studies showing the benefits and effectiveness that FCM brings such as research by. This teaching model has been widely tested in universities and colleges around the world. The flipped classroom model is considered an alternative method that combines education with technological advances. (Mandasari & Wahyudin, 2021). Previously, there have been many studies showing the benefits and effectiveness that FCM brings such as research by (Lo, 2020); (Mazlan et al., 2025) . This teaching model has been widely tested in universities and colleges around the world (Liu et al., 2016); (Jensen et al., 2018); being the first to successfully test the FCM method and has also proven its feasibility.

Along with international educational integration, in recent years IUH has made changes in higher education teaching, moving from the traditional instructor-based teaching model to an active learning experience. Positive and student-centered (Sakulprasertsri, 2017) and studies conducted in Vietnam such as (Hang & Van, 2020), (Xuan et al., 2023); (Thuy, 2024); (Pham, 2024) examining active teaching–

learning innovation strategies at Vietnamese universities, to encourage learners to focus on discussion spaces and activities that focus on multi-directional interactions between teachers and learners, and between learners to help them develop their competencies. self-study as well as cooperation and communication. MHLHDN is one of the methods currently being applied by IUH in engineering sectors (Tri & Trang, 2019).

Electrical and Electronics Engineering is the branch of engineering that deals with the practical applications of electricity in all its forms, including that in the field of electronics. Electrical and Electronics Engineering is the branch of Electrical Engineering that deals with the use of the electronic spectrum and the application of electronic devices such as integrated circuits and transistors. Electrical and Electronic Engineering studies and applies electricity, electronics and electromagnetism with many sub-specialties such as energy, electronics, control systems, signal processing, telecommunications... For this reason, promoting students' self-study ability, self-study and research skills helps them to study independently, or study together in groups, and work on projects. Through that, it helps students experience and practice creative thinking skills, thereby mastering and deepening knowledge, aiming for students after graduation to fully meet basic knowledge about careers, personal capacity, interpersonal communication skills, teamwork, problem solving and creativity. Using “flipped classroom” in teaching, especially in practical lessons in the field of Electricity, helps students to be proactive in their study time, while enhancing their responsibility in working in groups, demonstrating their acumen, creativity in thinking, and ability to design and operate products. And this is also the output standard to meet the requirements of employers after they graduate

That's why we want to launch a survey to collect feedback and suggestions from Faculty of Electrical Technology (FEET – IUH) students. With the novelty, practicality, and relevance of the problem, we implemented the study: "Evaluating the satisfaction of students learning using the flipped classroom model teaching method" **with 2 goals: (1)** describe students' learning effectiveness on FCM applied at IUH; (2) analyze some factors that influence their intention to use and impact their learning effectiveness.

2. LITERATURE REVIEW

"Flipped classroom" seeks to reverse traditional teaching roles and spaces. Pre-class knowledge is assigned by instructors to learners to review before coming to class for live sessions, while remaining time is limited. Back in class, you can carry out other forms of activities such as group work, presentations, and performances (Mizza et al., 2025). FCM learning allows students to maximize their learning and teachers have free time in the classroom to implement active teaching methods, as well as monitor and provide timely support for their needs. needs of each student (Zainuddin & Halili, 2016), (Abeysekera & Dawson, 2015). Traditional combined teaching methods such as direct question and answer and students' self-research aim to improve learners' capacity. Learners will understand knowledge more deeply and gain new knowledge that lecturers cannot provide. all the words in class (Wu et al., 2023). Today, with the global learning trend (Linh, 2024), international organizations and educational authorities recommend using many different methods to promote the learning process in the classroom to improve critical thinking ability (Tung, 2020), (Yu, 2025) and learning effectiveness for learners while applying scientific theory into practice . For this reason, at the Faculty of Electrical Technology - IUH, many specialized courses are suitable for using an online learning management system (LMS) with a flipped classroom (O'Flaherty et al., 2015)

In addition, in the university environment, self-study plays an important role for students because without self-study, students cannot complete their learning tasks according to the motto "turn the training process into a self-training process." ”. Self-study activities help students form basic competencies for "lifelong learning", meeting the educational innovation requirements of the entire society. At IUH, the "flipped classroom" method supports self-study as a teaching strategy, meaning learners use FCM to access knowledge and also have more direct supervision of their work. teacher learning through LMS.

Internationally, the flipped classroom model (FCM) has been widely implemented and proven effective in enhancing student engagement and learning outcomes. However, in Vietnam—particularly in technical disciplines—research remains limited, mainly focusing on describing perceptions and satisfaction levels, without quantitatively analyzing the factors influencing learning effectiveness and the intention to continue using FCM, as shown in Table 1 below

Table 1. Summary of previous studies related to the flipped classroom model

No.	Author(s), Year	Country /Context	Main focus / Variables studied	Key findings	Relation to current study
1	(Venkatesh et al., 2003)	International	Unified Theory of Acceptance and Use of Technology (UTAUT)	Identified 4 key constructs (performance expectancy, effort expectancy, social influence, facilitating conditions) affecting technology adoption	Basis for explaining students' intention to use FCM
2	(E. L. Deci & R. M. Ryan, 2008)	USA	Self-Determination Theory (SDT): autonomy, competence, relatedness	Motivation and self-regulation influence learning engagement	Provides theoretical foundation for self-study ability (CLC)
3	(Garrison et al., 1999); (Hew & Lo, 2018)	Canada / Asia	Community of Inquiry (CoI): teaching, social, cognitive presence	Highlighted importance of teacher–student interaction for effective blended learning	Supports Professional Elements in Teaching (PET) and Lecture preparation (PLS)
4	(Kalyuga, 2007)	Australia	Cognitive Load Theory (CLT)	Instructional design affects cognitive processing and learning efficiency	Relates to PLS and Effective learning in FCM
5	(Liu et al., 2016); (Liu et al., 2025)	China	Students' self-learning capacity in FCM	Self-study competence improves learning outcomes	Basis for Confidence and self-study ability (CLC)
6	(Luis R Murillo-Zamorano et al., 2019), (Murillo-Zamorano et al., 2021)	Spain	Professional competence of lecturers in FCM	Teachers' proficiency affects students' motivation and engagement	Basis for Professional elements in teaching (PET)
7	(Holguin-Alvarez et al., 2025); (Setren et al., 2021)	Latin America / USA	Technological and infrastructural support for FCM	Favorable conditions (FC) are prerequisites for effective learning	Basis for Favorable conditions (FC) variable
8	(Zainuddin & Perera, 2019); (Lo & Hew, 2017)	Malaysia / Hong Kong	Teachers' preparation and instructional design in FCM	Quality of lesson design impacts learning satisfaction	Supports Lecture preparation process (PLS)

9	(Aldridge & Fraser, 2016); (Zhai et al., 2017)	Australia / China	Classroom and home learning environment	Learning environment influences student confidence and participation	Supports Study environment (SES)
10	(Thuy, 2024); (Pham, 2024)	Vietnam	Implementation of active learning and FCM in higher education	Confirmed feasibility but lacked analysis of influencing factors	Indicates research gap in Vietnam context
11	(Tri & Trang, 2019); (Hang & Van, 2020)	Vietnam – IUH	Early adoption of FCM in engineering disciplines	Applied descriptively, not analytically tested	Direct gap for quantitative validation at IUH

In Vietnam, particularly in technical disciplines, most studies on the flipped classroom model (FCM) have so far remained at a descriptive level, focusing mainly on survey perceptions or satisfaction, without quantitatively testing the factors that influence the intention to use the model and learning effectiveness.

Previous theoretical models (such as UTAUT and TAM) have not fully integrated learning psychology factors (motivation, self-study ability, and cognitive load) and therefore do not comprehensively reflect the nature of learning in the flipped classroom model (FCM).

No previous study at IUH has tested the FCM model based on the factors Professional Elements in Teaching (PET), Confidence & Self-study Ability (CLC), Favorable Conditions (FC), Study Environment (SES), and Lecture Preparation (PLS) in relation to Intention to Use (UI) and Effective Learning (EL).

Although the flipped classroom model (FCM) has been widely implemented and shown to improve student engagement and learning outcomes in many international contexts, research on this model in Vietnam—especially in technical and engineering majors—remains limited. Most existing studies have primarily focused on the general perception and satisfaction of students, while few have analyzed the specific factors influencing students' learning outcomes and their behavioral intention to continue using the model.

Therefore, this study aims to fill this research gap by investigating how key factors such as self-study ability, technological support, lecturer–student interaction, and learning motivation affect students' satisfaction and learning outcomes under the FCM approach. The findings are expected to contribute both theoretically and practically to improving the application of FCM in higher education in Vietnam, particularly at technical universities like IUH.

3. HYPOTHESIS AND RESEARCH MODEL

3.1 Research hypothesis

Universities are now gradually applying global teaching methods, applying FLC to university education is necessary. To successfully apply FLC, user acceptance is the decisive factor. There are many different technology acceptance models such as the Theory of Reasoned Action (TRA) (Ajzen, 1977). Technology Acceptance Model (TAM) (Davis, 1989) and in this article the author inherits and promotes the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). The purpose of the study is to evaluate the level of expectations achieved when using the model through favorable conditions and behavioral intentions to use the model that affect students' learning effectiveness.

UTAUT model: The UTAUT model with the purpose of examining technology acceptance and using a more unified approach (Unified Theory of Acceptance and Use of Technology) was developed by (Venkatesh et al., 2003). The model is a combination of 8 models TRA, TAM, MM, TPB, C-TAM-TPB, MPCU, IDT, SCT. All of the above models are based on the author's most common point of view, which is to study user acceptance of an application of information technology in teaching.

FCM is a teaching method that lecturers apply to students during the learning process. Therefore, from the perspective of a lecturer, applying this model is inevitable to not only improve teaching effectiveness but also increase the ability and qualifications of lecturers in the university teaching process.

Recent studies suggest that understanding learning outcomes in flipped classrooms (FC) requires going beyond traditional technology adoption frameworks such as UTAUT or CLC, which primarily focus on behavioral intention to use technology (Venkatesh, 2012). In contrast, the flipped classroom involves complex motivational, cognitive, and social interactions that shape student engagement and performance. To capture these dimensions, this study integrates three complementary theories.

First, the Self-Determination Theory (SDT) emphasizes intrinsic motivation through autonomy, competence, and relatedness—key factors that foster self-regulated learning in FC environments (Edward L Deci & Richard M Ryan, 2008), (Abdullah, 2016).

Second, the Community of Inquiry (CoI) framework highlights cognitive, social, and teaching presence as essential components for effective blended and flipped learning experiences (Garrison et al., 1999); (Hew & Lo, 2018).

Third, the Cognitive Load Theory (CLT) explains how instructional design and media use influence learners' cognitive processing, directly affecting learning efficiency (Kalyuga, 2007). By integrating SDT, CoI, and CLT, this study extends previous theoretical approaches and provides a more comprehensive understanding of how motivation, engagement, and cognitive design jointly influence student learning outcomes in the flipped classroom context (Fischer et al., 2023).

"Professional elements in teaching - PET" : The core role of the model's active teaching method is according to the international learning conceptual framework presented to increase the employability of Generation Gen students Z in the digital age of the 21st century (L. R. Murillo-Zamorano et al., 2019). Classroom instructors need to clearly understand the utility and effectiveness of using FCM, and be proficient in the process of teaching according to FCM (Murillo-Zamorano et al., 2021). The results of the article's (NC) study provide an overview of how perceptions of effectiveness can influence intention to use FCM in a variety of countries (Haneefa, 2023), offering important insights on trends and practices in international education. Instructors adapt to technology training programs (Abd Rahman et al., 2021). Lecturers regularly train to improve their professional qualifications. Integration capabilities in the era of information technology development. In Vietnam, lecturers use Vietnamese (Phan et al., 2023) as the main language of instruction, however, to respond to the world integration situation, the lecturer's foreign language proficiency is very important, so the lecturer's foreign language proficiency is very important is very important (Pan & He, 2024).

Hypothesis 1 (H1): PE affects the intention to use the FCM model

Hypothesis 2 (H2): PE impacts learning effectiveness according to FCM

"Confidence _ Self-study capacity of students - CLC" : The process of evaluating the level of use of FCM in accordance with the teaching process requires students' active participation in class, the author (Liu et al., 2016) said. Create hypotheses and theories about developing students' self-study thinking, students' self-study skills and abilities are one of the factors contributing to the success of the model. In this study, the author proposes 4 QSs that impact students' confidence (Öztürk & Çakıroğlu, 2021) and ability when using FCM (Jalal Nouri, 2016), specifically as follows: Students can identify the lecture objectives themselves. Students know how to plan and carry out learning processes. Students can find resources for learning purposes and tasks. Students take notes on information they read, make additions, and pose their own learning problems (Han & Hamzah, 2024)

Hypothesis 3 (H3): CLC positively affects the intention to use the FCM model

"Favorable conditions – FC": Today information technology has a great influence on all aspects of social life, creating outstanding development. Building a technical infrastructure system that meets the process of applying technology to teaching activities will open up new horizons and new creative discoveries for people (Holguin-Alvarez et al., 2025). The use of flexible technology with "21st century learning" is consistent with developments in the digital technology era. In the case of lower-income students, less access to the internet will lead to ineffective learning (Setren et al., 2021), (Liu et al., 2025) so there needs to be a way to provide guidance to bring fairness to students. 3 BQS have an impact: The level of users' adequacy of technical, organizational, infrastructure and human support to use the

technology. Technology functions impact technology users. Situation of internet equipment at home (Redecker, 2017)

Hypothesis 4 (H4): FC positively affects the intention to use the FCM model

"Learning environment factor - SES" : The student's home learning environment, thematic room for students, the size and number of students in the classroom are necessary factors to meet the needs of students (Aldridge & Fraser, 2016). Successfully applied FCM and evaluated the level of student satisfaction when participating in studying at school. (Zhai et al., 2017) believes that a favorable atmosphere will improve psychological health and students will be more confident in the actual classroom (Zainuddin & Perera, 2019). Student's home learning environment. The school has a thematic room for students (Kim et al., 2014); Size and number of students in class (Huang et al., 2020).

Hypothesis 5 (H 5): SES positively affects the intention to use the FCM model

“ Lecture preparation process of lecturers – PLS ” : Although the flipped teaching method has its benefits, preparing lectures to teach students will require a lot of the lecturer's workload. In (Lo & Hew, 2017) order to increase student satisfaction with studying according to FCM, lecturers are required to carefully prepare lectures to teach, including searching and creating video lectures, lesson plan files, and exercises (Zainuddin & Halili, 2016); Teachers can identify units of knowledge applying the flipped classroom model; Teachers fully develop the content of classroom activities (Case exercises, projects...) (PLS3) (Chen et al., 2025); Lecturers develop lesson objectives for each class session (Hew & Lo, 2018), (Lo & Hew, 2017).

Hypothesis 6 (H6): PLS positively affects the intention to use the model

Hypothesis 7 (H7): PLS positively impacts learning effectiveness

Intermediary factor " Intention to use the flipped classroom model - UI " : Considered "a measure of a person's level of intention to perform a specific behavior", in this case, job intention (Yi & Hwang, 2003). (Abdullah, 2016) Applying FCM to teaching engineering students is truly necessary. (Yi et al., 2006) assessing intention to use evaluates the intention to continue learning according to FCM; Intention to Use FCM for Academic Purposes to Enhance Learning Competence (Rahmiati et al., 2020); Use MHLHDN to complete learning tasks (An et al., 2023) for engineering lecturers

Hypothesis 8 (H 8): UI positively impacts FCM learning efficiency

3.2 Research model

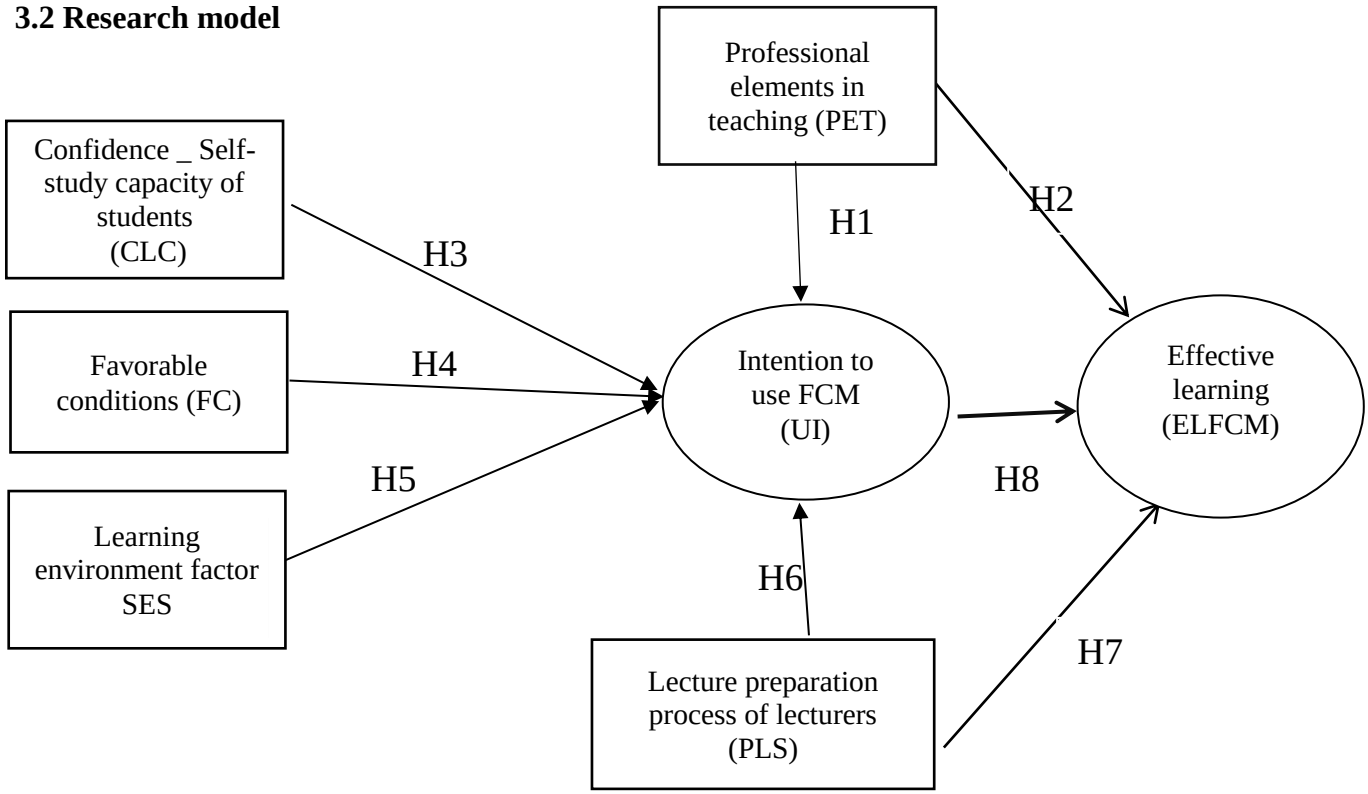

Figure 1. Proposed research framework

4. DATA AND RESEARCH DATA ANALYSIS

4.1 Research methods

In this study, the author combines qualitative and quantitative research methods to ensure the comprehensiveness and reliability of the results.

Qualitative research: Establishing the theoretical foundation and developing measurement scales, that is, using qualitative results to form observed variables and survey questions for the quantitative research stage.

Table 2: Research Measurement Scale Table

Factor	Observed Variables	References
Professional elements in teaching - PET	PET1-Research competence and academic contribution	PET→UI/ELFCM (Tri & Trang, 2019); (J. Nouri, 2016); (Murillo-Zamorano et al., 2021)
	PET2 - Curriculum design and pedagogical planning	
	PET3 - Communication and collaboration skills	
	PET4 - Teaching innovation and adaptability	
Confidence _ Self-study capacity of students (CLC)	CLC1 - Students can evaluate their own learning progress	CLC → UI → ELFCM (Liu et al., 2016); (van Alten et al., 2019) ; (Sun et al., 2023); (Naing et al., 2023); (Strelan et al., 2020)
	CLC2 - Students are confident in presenting and defending their viewpoints	
	CLC3 - Students can apply learned knowledge to solve real-life problems	
	CLC4 - Students persist in overcoming difficulties during self-study	
Favorable conditions – FC	FC1 - Institutional policies support technology use in teaching and learning	(Abd Rahman, 2021); (Mikalef et al., 2016); (Abd Rahman, 2021)
	FC2 - Administrative flexibility in technology-based learning	
	FC3 - Access to digital learning materials and online resources	
	FC4 – Availability of technical support during system operation	
Learning environment factor - SES	SES1 – The classroom environment encourages interaction and collaboration	SES → UI → ELFCM (Pan & He, 2024); (Alyoussef, 2022); (Naing et al., 2023); (Öz, 2023); (Setren et al., 2021); (van Alten et al., 2019); (Doo, 2022)
	SES2 - Learning environment promotes students' autonomy and creativity	
	SES3 - The physical and psychological classroom atmosphere is supportive	
	SES4 – Teachers prepare assessment tools consistent with flipped classroom objectives	
	SES5 – Teachers allocate appropriate time for in-class and out-of-class activities	
Lecture preparation	PLS1 - Lecturers' ability to design engaging pre-class learning materials	PLS → UI → ELFCM

process of lecturers – PLS	PLS2 - Time management skills in preparing flipped classroom content	(L. R. Murillo-Zamorano et al., 2019); (Zainuddin & Halili, 2016); (Abd Rahman et al., 2021); (Ullah, 2023)
	PLS3 - Lecturers' pedagogical competence in integrating active learning methods	
	PLS4 - Continuous reflection and improvement in lecture preparation	
	PLS5 - Institutional support and teaching environment for flipped classroom preparation	
Intention to use the flipped classroom model - UI	UI1 - Attitude toward the flipped classroom model	UI → ELFCM (Yi & Hwang, 2003); (Abdullah, 2016); (Yi et al., 2006); (Rahmiati et al., 2020)
	UI2 - Perceived enjoyment in using the flipped classroom model	
	UI3 - Self-efficacy in applying flipped learning methods	
	UI4 - Perceived usefulness for skill development	
	UI5 - Peer Influence / Learning Community Effect	
Learning effectiveness according to FCM (ELFCM)	ELFCM1 - Student Characteristics	(O'Flaherty et al., 2015); (Lo & Hew, 2017); (van Alten et al., 2019)
	ELFCM2 - Academic performance	
	ELFCM3 - Cognitive and problem-solving skills	
	ELFCM4 -Engagement and interaction	
	ELFCM5 -Learning attitude and motivation	

Quantitative research: Propose a practical model/framework. The author applies tools such as SPSS and SmartPLS to analyze the data. The collected data were processed using SMART PLS 4.1.0.0 and SPSS 22 software.

4.2. Research sample

The research data is primary, the author collected it from the survey by sending the link on the pre-designed questionnaire. The data collection process was supported by students of the IUH School of Electrical Engineering from January 2024 to April 2024. The survey results were processed to produce a final sample of 350 questionnaires, of which 305 were validly collected.

Table 3: Characteristics of the study sample

Characteristic	**Quantity**	**Ratio (%)**	**Characteristic**	**Quantity**	**Ratio (%)**
Research sample	**305**	**100%**		**305**	**100%**
Sex			**School year**		
Male	296	97.0%	2023-2024	43	14.0%
Female	9	3.0%	2022-2023	109	35.5%
			2021-2022	130	42.5%
			2020-2021	23	8.0%
Subject					
Theory	130	42.5%			
Practice	175	57.5%			

Source: Author's statistics

4.3. Check the reliability of the scale

To evaluate the reliability of the scale, the author applies four indices: Cronbach's Alpha (CA), Composite reliability(rho_a) , Composite reliability (rho_c) , Average variance extracted (AVE) .

Assessing the consistency of reliability, according to (Kline, 1999), (Springer et al., 2002), the Cronbach's Alpha index of each factor is greater than 0.7.

Evaluating convergence in SMART PLS, the loading factor of each observed variable is greater than 0.7 and the average variance extracted (AVE) value according to (Dijkstra & Henseler, 2015) suggests that a scale is valid. Convergent value: If AVE is 0.5 or higher, the scales of each variable in the model all achieve convergent value.

Table 4. Reliability and convergence analysis of each factor

Factor	Observed variables	Factor loading coefficient	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Professional elements in teaching (PET)	PET1	0.821	0.864	0.864	0.908	0.711
	PET2	0.852				
	PET3	0.822				
	PET4	0.876				
Student self-study capacity (CLC)	CLC1	0.828	0.849	0.875	0.898	0.689
	CLC2	0.710				
	CLC3	0.862				
	CLC4	0.909				
Favorable conditions (FC)	FC1	0.826	0.902	0.913	0.932	0.773
	FC2	0.891				
	FC3	0.889				
	FC4	0.909				
Learning environment factors (SES)	SES1	0.932	0.904	0.920	0.929	0.725
	SES2	0.872				
	SES3	0.752				
	SES4	0.832				
	SES5	0.858				
Lecture preparation process of lecturers (PLS)	PLS1	0.746	0.881	0.894	0.914	0.681
	PLS2	0.917				
	PLS3	0.822				
	PLS4	0.870				
	PLS5	0.756				
Intention to use the flipped	UI1	0.856	0.880	0.890	0.913	0.678
	UI2	0.808				

classroom model" (UI)	UI3	0.817				
	UI4	0.711				
	UI5	0.912				
Learning effectiveness according to FCM	ELFCM1	0.774	0.862	0.870	0.900	0.643
	ELFCM2	0.797				
	ELFCM3	0.819				
	ELFCM4	0.761				
	ELFCM5	0.855				

(Source: Processing results from SmartPLS 4.1.0.0)

After performing analysis using SMART 4.1.0.0 software for each observed variable of the scale, the factors have Cronbach's Alpha in the range from 0.849 to 0.904, meeting the requirements for statistical control of the scale. In addition, the average variance extracted (AVE) value fluctuates from 0.643 to 0.773 , all > 0.5, so the scale has converged value.

The results of the composite reliability test show that the Composite Reliability indices (rho_a) and (rho_c) of all factors achieved high values (Fornell & Larcker, 1981). Specifically, the rho_a coefficients range from 0.864 to 0.920, while the rho_c coefficients fall within the range of 0.898 to 0.932. According to the standards of researchers (Dijkstra & Henseler, 2015), (Henseler, 2017) và (Hair, 2014), these values all exceed the threshold of 0.7, indicating very good reliability. This demonstrates that the observed variables within each factor exhibit high internal consistency and effectively measure the same construct. No factor has a rho value exceeding 0.95, indicating that there is no redundancy among the observed variables. Among them, the factors FC, SES, and PLS have the highest rho values, demonstrating that their measurement scales are particularly stable. The remaining factors, such as PET, CLC, UI, and ELFCM, also demonstrate good reliability, ensuring the stability of the data. Thus, all measurement scales meet the requirements for composite reliability in the research model. This result confirms that the latent constructs are measured reliably, providing a solid foundation for subsequent analyses such as assessing convergent and discriminant validity.

4.4 Testing the difference value

According to (Fornell & Larcker, 1981), (Discriminant validity) is an assessment of the model's discriminant ability, the value is guaranteed when all items in a corresponding column of that variable have an upper value less than the line value. The corresponding diagonal or value from the square root of AVE for each research variable must be greater than the highest correlation value of this variable with another variable in the model.

Table 5. Correlation between structural variables

	CLC	**ELFCM**	**FC**	**PET**	**PLS**	**SES**	**UI**
CLC	0.830						
ELFCM	0.640	0.802					
FC	0.666	0.686	0.879				
PET	0.294	0.523	0.280	0.843			
PLS	0.560	0.655	0.719	0.307	0.825		
SES	0.739	0.539	0.598	0.279	0.483	0.851	
UI	0.741	0.798	0.798	0.375	0.776	0.668	0.824

(Source: Processing results from SmartPLS 4.1.0.0)

Results from table 5 show that the square root value of AVE ranges from 0.802 to 0.879 and is higher than the correlation coefficient between that factor and other factors. This proves that the model ensures the process of testing uniqueness.

Table 6. Heterotrait- Monotrait Ratio (HTMT) Index

	CLC	**ELFCM**	**FC**	**PET**	**PLS**	**SES**	**UI**

CLC							
ELFCM	0.716						
FC	0.744	0.758					
PET	0.326	0.611	0.314				
PLS	0.614	0.713	0.782	0.350			
SES	0.836	0.599	0.645	0.318	0.519		
UI	0.843	0.889	0.878	0.430	0.862	0.744	

(Source: Processing results from SmartPLS 4.1.0.0)

According to (Garson, 2016), (Susetyo & Lie, 2025), the discriminatory value between two latent variables is guaranteed when the HTMT index is less than 1. According to (Henseler et al., 2015) a discriminant value will be guaranteed if the HTMT index is below 0.9. Meanwhile, researchers (Clark & Watson, 1995) and (Kline, 2023) use a more stringent standard threshold of 0.85. And currently, the threshold of 0.9 is the most commonly used. And according to the results of the model, the achieved values are all less than 0.9, which proves that the difference value test is accepted.

4.5 Calculate collinearity of scale observed variables

Table 7. Summary of VIF magnification factors

Factor	VIF	Factor	VIF	Factor	VIF
CLC1	1.868	FC2	2.975	SES1	5.038
CLC2	1.554	FC3	2.814	SES2	3.480
CLC3	2.659	FC4	3.160	SES3	1.748
CLC4	3.241	PET1	1.851	SES4	2.553
ELFCM1	1.537	PET2	2.227	SES5	2.522
ELFCM2	1.925	PET3	1.889	UI1	2.594
ELFCM3	2.489	PET4	2.542	UI2	2.086
ELFCM4	1.906	PLS1	2.057	UI3	2.253
ELFCM5	2.961	PLS2	4.035	UI4	1.674
FC1	2.122	PLS3	2.611	UI5	3.370
PLS5	1.581	PLS4	2.971		

(Source: Author processed from SMART 4.1.0.0 software)

When reporting the VIF index to check for multicollinearity, according to (Hair et al., 2020), assume that all values below 5 meet the standard. However, according to (Kock, 2017) the more stringent threshold should be 3.3, not 5, so the authors eliminated 2 observed variables (VIP_PLS2 = 4.035; VIP_ SES1=5.038) from the research model.

After eliminating some inappropriate observed variables, the results showed that the remaining observed variables of the model did not have multicollinearity because all of VIF < 5. The results of the multicollinearity test of the observed variables are shown in Table 7.

4.6 R^2 and adjusted R^2

Table 8. Test of R^2 and adjusted R^2

	R^2	R^2 correction
UI	0.780	0.776
ELFCM	0.693	0.691

(Source: Author's processing results from SmartPLS 4.1.0.0)

The results from table 8 show that $R^2 = 0.691 > 0.5$ proves that the official research model is meaningful, the factors in the model can explain over 69.1% of the application of FCM after eliminating the hypothesis. H1 and H5.

4.7 Specific indirect effects:

Table 9. Specific indirect effects

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
CLC -> UI -> ELFCM	0.180	0.178	0.033	5.393	0.000
FC -> UI -> ELFCM	0.210	0.210	0.043	4.914	0.000
PET -> UI -> ELFCM	0.061	0.062	0.020	3.109	0.002
PLS -> UI -> ELFCM	0.222	0.222	0.041	5.450	0.000
SES -> UI -> ELFCM	0.082	0.083	0.031	2.627	0.009

All p-values are less than 0.05, indicating that the indirect effects through UI are statistically significant. The T-statistics values are all greater than 1.96, further confirming the reliability of the results (at the 5% significance level). The indirect coefficients (O) are positive, meaning that UI plays a positive mediating role — when the independent variables (CLC, FC, PET, PLS, SES) increase, UI also increases, thereby enhancing the level of ELFCM.

PLS → UI → ELFCM (0.222) has the strongest indirect effect, indicating that satisfaction with the learning platform (Perceived Learning Support) strongly influences FCM learning effectiveness through the level of user interaction. FC → UI → ELFCM (0.210) and CLC → UI → ELFCM (0.180) also have significant effects, reflecting the important roles of a flexible learning environment (FC) and technological competence (CLC). PET → UI → ELFCM (0.061) and SES → UI → ELFCM (0.082), though smaller, are still significant, indicating that personal and social factors also contribute through UI. PLS (0.222) has the strongest mediating effect, followed by FC (0.210) and CLC (0.180). Therefore, the PLS factor is statistically significant in the research model.

UI plays a statistically significant mediating role between the input variables (CLC, FC, PET, PLS, SES) and the output variable (ELFCM).

4.8 Official Models

The author uses PLS-SEM bootstrapping analysis. After the first test, the P-values of the hypotheses PLS -> ELFCM = 0.185 have a significance level (P-value) > 0.05, proving that hypotheses H6 are not statistically significant and should be eliminated from the model.

The above results show that the P-values of the effects are < 0.05, so these effects are all statistically significant. The author will eliminate each hypothesis to evaluate the appropriateness of the model.

Results of testing the official research model

Table 10. Summary of results of testing the coefficients of the official model

	Hypothesis	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
PET -> UI	H1	0.087	0.088	0.027	3.161	0.002
PET -> ELFCM	H2	0.261	0.263	0.053	4.949	0.000
CLC -> UI	H3	0.257	0.254	0.045	5.745	0.000
FC -> UI	H4	0.301	0.301	0.058	5.175	0.000
SES -> UI	H5	0.117	0.119	0.045	2.618	0.009
PLS -> UI	H6	0.318	0.318	0.055	5.771	0.000
UI -> ELFCM	H8	0.699	0.698	0.039	17.722	0.000

(Source: Author's processing results from SmartPLS 4.1.0.0)

After analyzing the regression model, the factor "lecture preparation process of lecturers" has a strong, same-directional impact on both intention to use and satisfaction of students learning using the FCM teaching method. The results of testing hypotheses H1, H2, H3, H4, H5, H6, and H8 are accepted. Most of

the survey results of factors are positively correlated with the intention to use FCM to impact students' learning efficiency and are consistent with the hypothesis. This result is similar to the studies of Liu et al. (2016) about the impact of lecturer qualifications, learning environment, and students' self-study ability. The research results are also similar to previous studies on assessing students' confidence and self-study ability. The proposed model explains a significant proportion of the impact of intention to use on learning effectiveness and is consistent with research models of many previous authors, such as on the process of accepting technology into teaching. Particularly, hypotheses H1 and H5 have a P value > 0.05, so the research hypothesis is rejected.

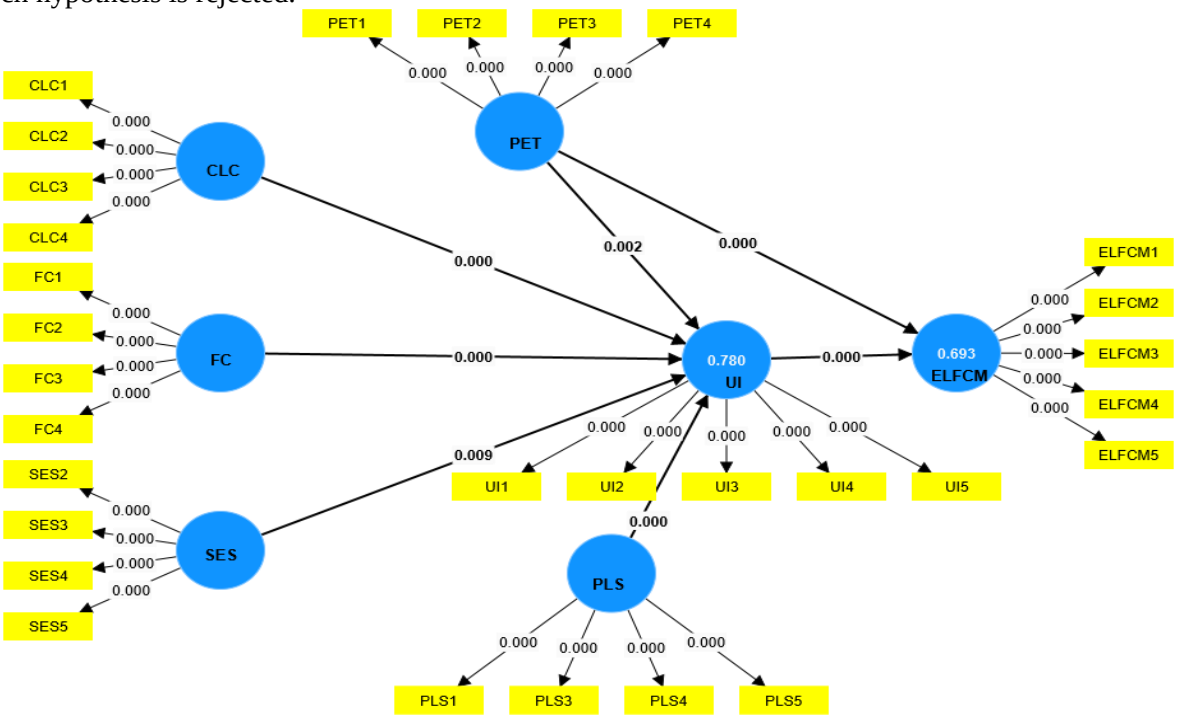

Figure 2: Formal research model

The analysis results indicate that the relationship between the intention to use the flipped classroom model (UI) and learning effectiveness (ELFCM) (H8) has a path coefficient of β = 0.699 with p = 0.000, indicating a very high level of statistical significance. This is the strongest relationship in the entire model, demonstrating that students' intention and readiness to adopt the flipped classroom model have a substantial impact on learning effectiveness. In other words, when students are proactive and engaged in approaching this model, their learning outcomes improve significantly.

The analysis of the model results shows that the relationship between lecturers' lesson preparation (PLS) and the intention to use the flipped classroom model (UI) (H6) has a path coefficient of β = 0.318 with p = 0.000, indicating a highly statistically significant relationship. This is the strongest input factor influencing the intention to use FCM, confirming that lecturers' thorough preparation in terms of content, teaching methods, and learning support materials is a key factor that motivates students to form the intention and readiness to adopt the flipped classroom model.

The third strongest influencing factor in the model is the relationship between favorable conditions (FC) and the intention to use the flipped classroom model (UI) (H4), with a path coefficient of β = 0.301 and p = 0.000, demonstrating that this relationship is highly statistically significant and has a strong impact. This indicates that support in terms of facilities, technological infrastructure, and institutional policies is an important factor contributing to encouraging students to develop the intention and readiness to engage in the flipped classroom model (FCM).

The research results show that students' confidence and self-learning ability (CLC) have a positive and relatively strong effect on the intention to use the flipped classroom model (UI) (H3), with β = 0.257 and p = 0.000, confirming that this relationship is statistically significant. This implies that students with higher confidence and better self-learning skills tend to be more proactive in adopting the flipped classroom

model, as they are willing to explore, research, and prepare knowledge before class, thereby enhancing their learning effectiveness in this active learning environment.

The analysis results show that the teaching expertise factor (PET) has a direct and statistically significant impact on both learning effectiveness (ELFCM) and the intention to use the flipped classroom model (UI). Specifically, the relationship PET → ELFCM (H2) has a path coefficient of $\beta = 0.261$ with $p = 0.000$, demonstrating that lecturers' professional competence, pedagogical methods, and instructional abilities play an important role in improving the quality and learning effectiveness of students within the FCM model.

Meanwhile, the relationship PET → UI (H1) has a path coefficient of $\beta = 0.087$ with $p = 0.002$, which is the weakest relationship in the model but still statistically significant. This indicates that although lecturers' professional competence influences students' intention to use the FCM model, it is not the main determining factor. Instead, it may be mediated or supported by other factors such as lesson preparation, learning conditions, or students' readiness.

The reason why the relationship PET → UI (H1), with a path coefficient of $\beta = 0.087$ and $p = 0.002$, is the weakest effect in the model can be explained by several factors:

First, lecturers' professional expertise (PET) primarily affects the intention to use the FCM model (UI) indirectly through mediating factors such as lecture quality, level of interaction, or lecturers' preparation (PLS). Therefore, the direct impact of PET on UI is reduced.

Second, the intention to use the flipped classroom model depends more on students' subjective factors, such as their readiness, confidence, self-learning ability (CLC), or the support provided by favorable learning conditions (FC), rather than on lecturers' professional competence.

Third, in the flipped classroom learning environment, the role of lecturers shifts from being knowledge transmitters to facilitators and supporters. Therefore, although professional expertise remains important, it is no longer the decisive factor for students to form the intention to participate in the FCM model.

In summary, the weak effect of PET on UI reflects the reality that students' intentions are mainly influenced by factors related to themselves and their learning environment, rather than by lecturers' pure professional competence.

The analysis results show that the learning environment factor (SES) has a positive but moderately weak effect on the intention to use the flipped classroom model (UI) (H5), with $\beta = 0.117$ and $p = 0.009$, indicating that this relationship is statistically significant. This suggests that a friendly, cooperative learning environment with strong lecturer–student support can encourage students to participate in the FCM model; however, the level of influence is not particularly strong. The reason may be that the learning environment serves primarily as a supportive foundation, while more active and direct factors, such as lecturers' preparation (PLS) or favorable conditions (FC), have a more pronounced impact on students' intention to use the flipped classroom model.

The results show that hypothesis H6 (PLS → ELFCM) has $\beta = 0.185$ and $p > 0.05$, indicating that this relationship is not statistically significant and should be removed from the research model. This removal does not substantially affect the overall model fit, as the model still maintains reliability and explanatory power if the remaining relationships are significant.

However, from a theoretical perspective, eliminating H6 removes the direct path that reflects the lecturer's role in enhancing learning effectiveness. The results also suggest that lecturers' lesson preparation may have an indirect effect through the intention to use the FCM model (UI) rather than a direct impact on learning effectiveness.

This could be due to the PLS measurement scale not fully capturing the quality of teaching preparation, or because students' active role in the FCM model plays a more decisive part. Nevertheless, the PLS factor still influences ELFCM indirectly through the mediating variable UI, and further testing of UI's mediating role is recommended.

5. CONCLUSION AND POLICY IMPLICATIONS

5.1 Conclusion

In Vietnam, in recent years, many lecturers have become increasingly interested in using FCM in teaching at universities. However, previous studies mainly focused on the success of application to theoretical classes. In this article, the author focuses on studying the learning effectiveness of students learning models in classes that teach both theory and practice in the subject of Electrical Engineering. Based on research, through the impact factors of the model, the author will disseminate factors that positively impact efficiency when using the model. Build a theoretical and practical framework to help lecturers and students have the best approach to learning in the era of information technology development.

5.2 Proposal

After the data analysis process, the results of the model were completed and a good assessment of the intention to use the model and the learning outcomes were obtained. However, in order to operate the model more effectively, the author proposes some solutions to effectively apply it to electrical engineering classes:

- " Professional elements in teaching ": Although the direct impact of PET on UI is relatively weak, its influence on learning effectiveness (ELFCM) remains significant. Policymakers and university administrators should focus on continuous professional development programs to improve lecturers' pedagogical methods, instructional communication, and assessment design. Encouraging international academic exchange or advanced certification programs in innovative teaching methods can further enhance teaching quality.
- " Confidence _ Self-study capacity of students": To improve the learning efficiency of FCM students, lecturers need to awaken students' self-study potential and encourage the spirit of creativity through activities. case studies or small competition programs to train students' self-discipline and positivity about their grades in the classroom. Students regularly exchange studies and help each other improve their professional capacity. CLC positively affect students' intention to use the FCM, educational policies should aim to cultivate autonomous learning skills. Lecturers should integrate project-based learning, peer collaboration, and problem-solving activities to foster self-discipline and motivation. Universities can also offer short workshops on digital literacy, time management, and self-directed learning strategies to prepare students for FCM participation.
- "Favorable conditions": Along with the strong development of the digital era, students need to improve their ability to use information technology through information technology courses. The state needs to upgrade technical infrastructure and information technology infrastructure to help enhance the ability to access, store, retrieve and process data when participating in learning under FCM. The study confirms that FC significantly influence students' intention to adopt the FCM. Therefore, universities need to ensure adequate facilities, stable internet connectivity, and modern learning management systems (LMS) to support online and blended learning. Administrative policies should also be adjusted to facilitate flexible scheduling, digital resource sharing, and online assessment integration.
- "Learning environment factor": There is an interaction between the learning environment at home and the learning environment at school. Regarding the school, it is necessary to fully equip students with equipment, depending on each class to determine the number of students appropriate to the subject's program. The learning environment (SES) also shows a statistically significant, though moderate, effect on students' intention to use FCM. Hence, universities should promote a culture of collaboration between lecturers and students, encourage open communication, and provide academic counseling or mentoring programs. Creating online communities and discussion forums can further enhance engagement and social interaction in the flipped learning context.
- "Lecture preparation process of lecturers": In addition to preparing good classroom lectures to provide students with learning, lecturers need to look for abundant resources, documents, reference books, and textbooks. monograph for students to research on their own. Lecturers should build digital lectures so that students can easily access subjects according to the curriculum and new knowledge. PLS has the strongest indirect effect on learning effectiveness through *Intention to Use (UI)*, universities should provide systematic training programs to help lecturers design, prepare, and implement high-quality flipped lessons. Institutions should encourage the use of digital teaching materials, video lectures, and interactive platforms that allow students to review content before class. Incentive policies, such as teaching innovation grants or performance-based rewards, should be introduced to motivate lecturers to continuously improve their teaching design

5.3 Limitation

This study still has several limitations. First, the survey sample is limited to electrical engineering students from a single university in Vietnam; therefore, the results may not fully represent other disciplines or contexts. Second, the study uses cross-sectional data collected at one point in time, which prevents establishing causal relationships between the variables in the model. Third, the measurement scales are based on students' self-assessments through questionnaires, which may be affected by cognitive bias or social desirability tendencies. In addition, the study has not examined other potential mediating or moderating factors—such as learning motivation, technological proficiency, or teaching styles of lecturers—that may influence students' intention and learning effectiveness when adopting the flipped classroom model.

5.4 Future research

Future research could expand the scope of this study in several directions. First, subsequent studies should include a larger and more diverse sample across different disciplines and universities to enhance the generalizability of the findings. Second, longitudinal research designs could be applied to better examine the causal relationships between variables and the long-term effects of the flipped classroom model (FCM) on learning outcomes. Third, future studies could incorporate additional mediating and moderating factors, such as students' learning motivation, digital competence, or lecturers' teaching styles, to provide a more comprehensive understanding of how these elements interact to influence learning effectiveness. Finally, qualitative or mixed-method approaches, such as interviews or classroom observations, could be employed to gain deeper insights into students' experiences and perceptions when participating in FCM-based learning environments.

REFERENCES

[1] Abd Rahman, S. F., Md Yunus, M., & Hashim, H. (2021). Applying utaut in predicting esl lecturers intention to use flipped learning [Article]. *Sustainability (Switzerland), 13*(15), Article 8571. https://doi.org/10.3390/su13158571

[2] Abdullah, F., & Ward, R. (2016). Developing a General Extended Technology Acceptance Model for E-Learning (GETAMEL) by analysing commonly used external factors. *Computers in human behavior, , 56, 238-256.* https://doi.org/https://doi.org/10.1016/j.chb.2015.11.036

[3] Abeysekera, L., & Dawson, P. (2015). Motivation and cognitive load in the flipped classroom: definition, rationale and a call for research [Article]. *Higher Education Research and Development*, *34*(1), 1-14. https://doi.org/10.1080/07294360.2014.934336

[4] Ajzen, I., & Fishbein, M. (1977). Attitude-behavior relations: A theoretical analysis and review of empirical research. . *Psychological bulletin, , 84(5), 888.* https://doi.org/https://psycnet.apa.org/doi/10.1037/0033-2909.84.5.888

[5] Aldridge, J. M., & Fraser, B. J. (2016). Teachers' views of their school climate and its relationship with teacher self-efficacy and job satisfaction [Article]. *Learning Environments Research*, *19*(2), 291-307. https://doi.org/10.1007/s10984-015-9198-x

[6] Alyoussef, I. Y. (2022). Acceptance of a flipped classroom to improve university students' learning: An empirical study on the TAM model and the unified theory of acceptance and use of technology (UTAUT). *Heliyon, 8(12).* https://doi.org/https://doi.org/10.1016/j.heliyon.2022.e12529

[7] An, X., Chai, C. S., Li, Y., Zhou, Y., Shen, X., Zheng, C., & Chen, M. (2023). Modeling English teachers' behavioral intention to use artificial intelligence in middle schools [Article]. *Education and information technologies*, *28*(5), 5187-5208. https://doi.org/10.1007/s10639-022-11286-z

[8] Clark, L. A., & Watson, D. (1995). Constructing Validity: Basic Issues in Objective Scale Development [Article]. *Psychological Assessment*, *7*(3), 309-319. https://doi.org/10.1037/1040-3590.7.3.309

[9] Chen, F. Z., Chen, L. A., Tseng, C. C., Pai, C. H., Tsai, K. E., Liang, E. C., Chen, Y. F., Chen, T. L., Liu, S. Y., Lee, P. C., Lai, K. C., Liu, B. R., Fouad, K. E., & Chen, C. W. (2025). Enhancing student engagement and learning outcomes in life sciences: implementing interactive learning environments and flipped classroom models [Article]. *Discover Education*, *4*(1), Article 102. https://doi.org/10.1007/s44217-025-00501-x

[10] Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. . *MIS quarterly, , 319-340.* https://doi.org/https://doi.org/10.2307/249008

[11] Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian psychology/Psychologie canadienne*, *49*(3), 182.

[12] Dijkstra, T. K., & Henseler, J. (2015). Consistent partial least squares path modeling. *MIS quarterly*, *39*(2), 297-316.

[13] Doo, M. Y. (2022). Understanding Flipped Learners' Perceptions, Perceived Usefulness, Registration Intention, and Learning Engagement [Article]. *Contemporary Educational Technology*, *14*(1), Article ep331. https://doi.org/10.30935/cedtech/11368
[14] Fischer, K., Sullivan, A. M., Cohen, A. P., King, R. W., Cockrill, B. A., & Besche, H. C. (2023). Using cognitive load theory to evaluate and improve preparatory materials and study time for the flipped classroom [Article]. *BMC Medical Education*, *23*(1), Article 345. https://doi.org/10.1186/s12909-023-04325-x
[15] Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of marketing research*, *18*(1), 39-50.
[16] Garrison, D. R., Anderson, T., & Archer, W. (1999). Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education [Article]. *Internet and Higher Education*, *2*(2-3), 87-105. https://doi.org/10.1016/S1096-7516(00)00016-6
[17] Garson, G. D. (2016). Partial least squares. Regression and structural equation models. In: Statistical Publishing Associates.
[18] Hair, J. F. (2014). *A primer on partial least squares structural equation modeling (PLS-SEM)*. sage.
[19] Hair, J. F., Howard, M. C., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis [Article]. *Journal of Business Research*, *109*, 101-110. https://doi.org/10.1016/j.jbusres.2019.11.069
[20] Han, W., & Hamzah, M. (2024). Research on the influence of flipped classroom on self-efficacy in English language learning of Chinese higher vocational college students [Article]. *Discover Education*, *3*(1), Article 11. https://doi.org/10.1007/s44217-024-00097-8
[21] Haneefa, M. M. (2023). The use of online flipped classrooms during covid-19 by gifted students: A path analysis using UTAUT model. *International Journal of Instruction*, *16*(2), 213-228.
[22] Hang, L. T., & Van, V. H. (2020). Building strong teaching and learning strategies through teaching innovations and learners' creativity: A study of vietnam universities [Article]. *International Journal of Education and Practice*, *8*(3), 498-510. https://doi.org/10.18488/journal.61.2020.83.498.510
[23] Henseler, J. (2017). Partial least squares path modeling. In *Advanced methods for modeling markets* (pp. 361-381). Springer.
[24] Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling [Article]. *Journal of the academy of marketing science*, *43*(1), 115-135. https://doi.org/10.1007/s11747-014-0403-8
[25] Hew, K. F., & Lo, C. K. (2018). Flipped classroom improves student learning in health professions education: A meta-analysis [Article]. *BMC Medical Education*, *18*(1), Article 38. https://doi.org/10.1186/s12909-018-1144-z
[26] Holguin-Alvarez, J., Cruz-Montero, J., Ruiz-Salazar, J., Atoche Wong, R. L., & Merino-Flores, I. (2025). Effects of feedback dynamics and mixed gamification on cognitive underachievement in school [Article]. *Contemporary Educational Technology*, *17*(1), Article ep551. https://doi.org/10.30935/cedtech/15717
[27] Huang, R. H., Liu, D., Tlili, A., Yang, J., Wang, H., & Zhang, M. (2020). Handbook on facilitating flexible learning during educational disruption: The Chinese experience in maintaining undisrupted learning in COVID-19 outbreak. *Beijing: Smart Learning Institute of Beijing Normal University*, *46*.
[28] Jensen, J. L., Holt, E. A., Sowards, J. B., Heath Ogden, T., & West, R. E. (2018). Investigating Strategies for Pre-Class Content Learning in a Flipped Classroom [Article]. *Journal of Science Education and Technology*, *27*(6), 523-535. https://doi.org/10.1007/s10956-018-9740-6
[29] Kalyuga, S. (2007). Enhancing instructional efficiency of interactive e-learning environments: A cognitive load perspective [Article]. *Educational psychology review*, *19*(3), 387-399. https://doi.org/10.1007/s10648-007-9051-6
[30] Kim, M. K., Kim, S. M., Khera, O., & Getman, J. (2014). The experience of three flipped classrooms in an urban university: An exploration of design principles [Article]. *Internet and Higher Education*, *22*, 37-50. https://doi.org/10.1016/j.iheduc.2014.04.003
[31] Kline, R. B. (1999). Book review: Psychometric theory. *Journal of Psychoeducational Assessment*, *17*(3), 275-280.
[32] Kline, R. B. (2023). *Principles and practice of structural equation modeling*. Guilford publications.
[33] Kock, N. (2017). Common method bias: A full collinearity assessmentmethod for PLS-SEM. In *Partial Least Squares Path Modeling: Basic Concepts, Methodological Issues and Applications* (pp. 245-257). https://doi.org/10.1007/978-3-319-64069-3_11
[34] Linh, N. T. Y., & Ut, D. (2024). The level of learners' satisfaction with the Flipped Classroom model. *Journal of educational equipment: Applied research, , 2(309).*
[35] Liu, K., Hao, Z., Chen, J., Wu, Q., Jin, W., Pan, Y., & Zhang, X. (2025). Impact of Flipped Classroom Instruction on Brain-Mediated Motor Skill Performance in University Students: A Systematic Review and Meta-Analysis [Review]. *Brain Sciences*, *15*(5), Article 501. https://doi.org/10.3390/brainsci15050501
[36] Liu, L., Ripley, D., & Lee, A. (2016). Flipped learning and influential factors: Case analysis. *Journal of Educational Technology Development and Exchange (JETDE)*, *9*(2), 5.

[37] Lo, C. K. (2020). Systematic reviews on flipped learning in various education contexts. *Systematic reviews in educational research: Methodology, perspectives and application*, *29*(7), 129-143.
[38] Lo, C. K., & Hew, K. F. (2017). A critical review of flipped classroom challenges in K-12 education: possible solutions and recommendations for future research [Review]. *Research and Practice in Technology Enhanced Learning*, *12*(1), Article 4. https://doi.org/10.1186/s41039-016-0044-2
[39] Mandasari, B., & Wahyudin, A. Y. (2021). Flipped classroom learning model: implementation and its impact on EFL learners' satisfaction on grammar class. *Ethical Lingua: Journal of Language Teaching and Literature*, *8*(1), 150-158.
[40] Mazlan, R., Mahamod, Z., & Jamaludin, K. A. (2025). Comprehensive structured review of implementing flipped classroom approaches in education [Article]. *Journal of Education and Learning*, *19*(3), 1651-1661. https://doi.org/10.11591/edulearn.v19i3.22655
[41] Mikalef, P., Pappas, I. O., & Giannakos, M. N. (2016). Investigating determinants of video-based learning acceptance [Article]. *Lecture Notes in Educational Technology*(9789812878663), 483-491. https://doi.org/10.1007/978-981-287-868-7_57
[42] Mizza, D., Reese, M., & Malouche, D. (2025). Flipped classroom evaluation and blended learning potential: a case study of engagement and inclusion in quantitative education [Article]. *Smart Learning Environments*, *12*(1), Article 56. https://doi.org/10.1186/s40561-025-00412-2
[43] Murillo-Zamorano, L. R., López Sánchez, J. Á., & Godoy-Caballero, A. L. (2019). How the flipped classroom affects knowledge, skills, and engagement in higher education: Effects on students' satisfaction [Article]. *Computers and Education*, *141*, Article 103608. https://doi.org/10.1016/j.compedu.2019.103608
[44] Murillo-Zamorano, L. R., López Sánchez, J. Á., Godoy-Caballero, A. L., & Bueno Muñoz, C. (2021). Gamification and active learning in higher education: is it possible to match digital society, academia and students' interests? *International Journal of Educational Technology in Higher Education*, *18*(1), 15.
[45] Naing, C., Whittaker, M. A., Aung, H. H., Chellappan, D. K., & Riegelman, A. (2023). The effects of flipped classrooms to improve learning outcomes in undergraduate health professional education: A systematic review [Review]. *Campbell Systematic Reviews*, *19*(3), Article e1339. https://doi.org/10.1002/cl2.1339
[46] Nouri, J. (2016). The flipped classroom: for active, effective and increased learning – especially for low achievers [Article]. *International Journal of Educational Technology in Higher Education*, *13*(1), Article 33. https://doi.org/10.1186/s41239-016-0032-z
[47] O'Flaherty, J., Phillips, C., Karanicolas, S., Snelling, C., & Winning, T. (2015). Erratum: The use of flipped classrooms in higher education: A scoping review (The Internet and Higher Education (2015) 25 (85-95)) [Erratum]. *Internet and Higher Education*, *27*, 90. https://doi.org/10.1016/j.iheduc.2015.05.001
[48] Öz, A. M., & Kala, N. (2023). Explorations to Overcome Socio-Economic Barriers in Learning and Thinking: A Flipped Classroom Study. *Science Insights Education Frontiers*, , *18(1), 2759-2783.* https://doi.org/https://orcid.org/0000-0002-4608-708X
[49] Öztürk, M., & Çakıroğlu, Ü. (2021). Flipped learning design in EFL classrooms: implementing self-regulated learning strategies to develop language skills [Article]. *Smart Learning Environments*, *8*(1), Article 2. https://doi.org/10.1186/s40561-021-00146-x
[50] Pan, Y., & He, W. (2024). Research on the influencing factors of promoting flipped classroom teaching based on the integrated UTAUT model and learning engagement theory [Article]. *Scientific Reports*, *14*(1), Article 15201. https://doi.org/10.1038/s41598-024-66214-7
[51] Pham, N. T., Tran, D., Nguyen, A. T. T., & Huynh, B. T. (2024). High School Students' Statistical Literacy Changes in a Flipped Classroom Environment: A Quasi-Experimental Study. *Vietnam Journal of Education*, , *91-101*. https://doi.org/https://doi.org/10.52296/vje.2024.365
[52] Phan, H. L. T., Nguyen, D. T. B., & Phung, D. T. (2023). English-medium-instruction in Vietnamese universities: Pitfalls, accomplishments, and impact on graduate employability. In *English language education for graduate employability in Vietnam* (pp. 283-303). Springer Nature Singapore Singapore.
[53] Rahmiati, Z., Muluk, S., Akmal, S., & Aziz, Z. A. (2020). Language, identity, and ideology: Analysing discourse in Aceh sharia law implementation [Article]. *Indonesian Journal of Applied Linguistics*, *9*(3), 599-607. https://doi.org/10.17509/ijal.v9i3.23210
[54] Redecker, C. (2017). DigCompEdu. *Beurteilung der Digitalen Kompetenz Lehrende. Online verfügbar unter https://joint-research-centre. ec. europa. eu/system/files/2018-09/digcompedu_leaflet_de_2018-01. pdf (abgerufen am: 20.11. 2020)*.
[55] Sakulprasertsri, K. (2017). Flipped Learning Approach: Engaging 21st Century Learners in English Classrooms. *LEARN Journal: Language Education and Acquisition Research Network*, *10*(2), 132-143.
[56] Setren, E., Greenberg, K., Moore, O., & Yankovich, M. (2021). Effects of flipped classroom instruction: evidence from a randomized trial [Article]. *Education Finance and Policy*, *16*(3), 363-387. https://doi.org/10.1162/edfp_a_00314

[57] Springer, D. W., Abell, N., & Hudson, W. W. (2002). Creating and validating rapid assessment instruments for practice and research: Part 1. *Research on Social Work Practice*, *12*(3), 408-439.
[58] Strelan, P., Osborn, A., & Palmer, E. (2020). The flipped classroom: A meta-analysis of effects on student performance across disciplines and education levels [Review]. *Educational Research Review*, *30*, Article 100314. https://doi.org/10.1016/j.edurev.2020.100314
[59] Sun, Y., Zhao, X., Li, X., & Yu, F. (2023). Effectiveness of the flipped classroom on self-efficacy among students: A meta-analysis [Review]. *Cogent Education*, *10*(2), Article 2287886. https://doi.org/10.1080/2331186X.2023.2287886
[60] Susetyo, B., & Lie, A. (2025). Quality indicators of vocational schools: Partial least squares-SEM for small sample [Article]. *MethodsX*, *15*, Article 103620. https://doi.org/10.1016/j.mex.2025.103620
[61] Tung, Đ., & Kien, H. C. (2020). The application of the flipped classroom model in online teaching at Hung Vuong university. *Journal of science and technology hung vuong university*, *19(2), 37-45*.
[62] Thuy, T. T., Linh, K., & Tam, P. T. T. (2024). Applying Flipped Classroom in teaching and learning EFL for undergraduate students: Perceptions and attitudes. . *Ho Chi Minh City open University journal of Science*, *19(1), 85-96*. https://doi.org/ 10.46223/HCMCOUJS.soci.vi.19.1.3018.2024
[63] Tri, N. M., & Trang, D. X. P. (2019). Applying flipped classroom approach in business writing courses: A case study at HCMC University of Education. Proceedings of the 7th OpenTESOL International Conference,
[64] Ullah, K., & Jinah, S. (2023). Effectiveness of Flipped Classrooms in Promoting Student Learning at the Tertiary Level. . *ProScholar Insights*, *, 2(1), 28-39*. https://doi.org/https://doi.org/10.62997/psi.2023a.54109
[65] Van Alten, D. C. D., Phielix, C., Janssen, J., & Kester, L. (2019). Effects of flipping the classroom on learning outcomes and satisfaction: A meta-analysis [Review]. *Educational Research Review*, *28*, Article 100281. https://doi.org/10.1016/j.edurev.2019.05.003
[66] Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478.
[67] Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. . *MIS quarterly*, *, 157-178*. https://doi.org/https://doi.org/10.2307/41410412
[68] Wu, W., Liu, Y., Yu, L., & Wei, W. (2023). Analysis of the Effect of Applying VR Technology in Cross-Cultural Art Course. Lecture Notes in Computer Science,
[69] Xuan, T. T. H., Thanh, N. B. H., & Nhi, N. T. (2023). Factors Affecting the Flipped Classroom in the Educational Context of Vietnam. *Journal of Education and e-Learning Research*, *10*(2), 99-110.
[70] Yi, M. Y., & Hwang, Y. (2003). Predicting the use of web-based information systems: Self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model [Article]. *International Journal of Human Computer Studies*, *59*(4), 431-449. https://doi.org/10.1016/S1071-5819(03)00114-9
[71] Yi, M. Y., Jackson, J. D., Park, J. S., & Probst, J. C. (2006). Understanding information technology acceptance by individual professionals: Toward an integrative view [Article]. *Information and Management*, *43*(3), 350-363. https://doi.org/10.1016/j.im.2005.08.006
[72] Yu, J. H. (2025). Integrating actionable analytics into learning design for MOOCs: a design-based research: JH Yu. *Journal of Computing in Higher Education*, *37*(3), 993-1031.
[73] Zainuddin, Z., & Halili, S. H. (2016). Flipped classroom research and trends from different fields of study [Article]. *International review of research in open and distributed learning*, *17*(3), 313-340. https://doi.org/10.19173/irrodl.v17i3.2274
[74] Zainuddin, Z., & Perera, C. J. (2019). Exploring students' competence, autonomy and relatedness in the flipped classroom pedagogical model [Article]. *Journal of Further and Higher Education*, *43*(1), 115-126. https://doi.org/10.1080/0309877X.2017.1356916
[75] Zhai, X., Gu, J., Liu, H., Liang, J. C., & Tsai, C. C. (2017). An experiential learning perspective on students' satisfaction model in a flipped classroom context [Article]. *Educational Technology and Society*, *20*(1), 198-210. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010417115&partnerID=40&md5=52696d8a36ceb1ee136716d114c434df
[76] Ngo Tu Thanh, Nguyen Quoc Vu (2019). Self-study guidance in the era of "5th level of technology" to develop students' capacity. Journal of Education, No. 465, pp. 43-47.

NHỮNG YẾU TỐ NÀO ẢNH HƯỞNG NHIỀU NHẤT ĐẾN KẾT QUẢ HỌC TẬP CỦA SINH VIÊN KHI SỬ DỤNG MÔ HÌNH LỚP HỌC ĐẢO NGƯỢC? MỘT NGHIÊN CỨU TRƯỜNG HỢP Ở VIỆT NAM

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Tóm tắt. Bài báo nghiên cứu về hiệu quả học tập của sinh viên khi tiếp thu kiến thức theo mô hình lớp học đảo ngược (FCM). Đối tượng tham gia nghiên cứu gồm 305 sinh viên thuộc Khoa Công nghệ Điện, Trường Đại học Công nghiệp Thành phố Hồ Chí Minh (IUH). Thiết kế nghiên cứu sử dụng phương pháp mô tả định tính thông qua việc trả lời 32 câu hỏi theo thang đo Likert 5 mức độ. Tác giả đã kết hợp các phương pháp phân tích định tính, định lượng và phân tích hồi quy để đưa ra kết quả nghiên cứu về 07 nhân tố ảnh hưởng đến hiệu quả học tập của những sinh viên có ý định sử dụng mô hình FCM. Điểm khác biệt của nghiên cứu này so với các nghiên cứu trước đây là tập trung khám phá tác động của các nhân tố đối với hiệu quả học tập cụ thể của sinh viên chuyên ngành Công nghệ điện khi học theo phương pháp FCM. Từ đó, giảng viên có thể tìm ra các giải pháp để triển khai giảng dạy theo mô hình này một cách hiệu quả hơn.

Từ khóa: Mô hình lớp học đảo ngược, phương pháp giảng dạy, giảng dạy, tự học.

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