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Factors affecting the flipped classroom in the educational context of Vietnam

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Abstract

In the context of the implementation of the 2018 General Education Program, teachers are required to implement a teaching model oriented to the development of students' quality and competence. Teachers are encouraged to adapt the flipped classroom model of teaching in schools as its advantages are suitable for novel teaching strategies. This study focuses on analyzing factors affecting the application of this model in the teaching and learning process by collecting feedback from 351 teachers from various cities in Vietnam. The questionnaire included Likert-type questions analyzed by IBM SPSS Statistics version 20 for quantitative analysis and an open question for qualitative analysis with context and personal information. The research-oriented factors focus on the group of potential internal factors (perception, proficiency, desire and readiness of teachers) and the group of external factors (infrastructure, facilities and support resources, training programs). The results showed that those factors include the school's infrastructure and information communication technology (ICT) condition, the teacher's ICT competence as well as competence-related teaching and assessment methodologies and the students' internet access conditions. Finally, the study offers suggestions on how to apply this model in teaching practice to meet the requirements of educational innovation in Vietnam.

Keywords: Blended learning, Competence-oriented teaching and learning, Flipped classroom model, Flipped learning, Influence factors, Inverted learning.

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Contents

Contribution of this paper to the literature

The study focused on analyzing factors affecting the adoption of the flipped classroom model in the educational context of Vietnam during the renovation period with the goal of developing students' competence. The study focused on factors related to human resources and facilities in the context of the digital transformation of teaching in schools.

1. Introduction

In the era of "Industrial Revolution 4.0," innovation in teaching methods oriented toward the development of students' qualities and competencies requires a change in thinking about teaching methods, information transmission and organizing learning activities in a flexible learning environment. The flipped classroom model (FCM) was proposed by Aaron Sam with the aim of converting direct instruction to video to increase students' self-study at home and their spending time in communication, discussion in class, helping to deepen knowledge and enhance students' critical thinking (Bergmann & Sams, 2012).

This model allows students to learn with different learning styles in various flexible learning environments at suitable individual learning times ensuring that they meet the course learning outcomes. This model is also beneficial for teachers in organizing individual and group learning activities in a variety of different environment which helps to enhance the effectiveness of the process of developing students' competences including self-study, critical thinking and creative thinking. Compared to the traditional classroom, this model allows learners to actively participate in the teaching-learning process (Aliye, Jaramillo Cherrez, & Jahren, 2018) with different kinds of social interaction including teacher- learner, learner-learner and learner-society interaction (Srinivasan & Tyagi, 2020). It allows students to learn in active learning opportunities (Demski, 2013; Gannod, Burge, & Helmick, 2008) and helps to increase the effectiveness of interaction in the learning process (Danker, 2015; Kunz, 2013). In addition, this help teachers get a deeper insight into the cognitive level and learning process of students (Roehl, Reddy, & Shannon, 2013), detect students' misconceptions in order to take timely intervention measures (Johnson & Renner, 2012) and effectively organize student-centered learning to coordinate the assessment of students' learning process. There have been various qualitative and quantitative studies analyzing the influence of this model on teaching quality. The latest studies focus on analyzing the influence of this model on student achievement (Kamaruddeen & Nordin, 2019; Kinyaduka, Kalimasi, & Heikkinen, 2019; Saterbak, Volz, & Wettergreen, 2016; Schultz, Duffield, Rasmussen, & Wageman, 2014; Tune, Sturek, & Basile, 2013; Xinzhuo, Yanqing, Yan, Wenguo, & Lijie, 2021), students' classroom engagement (Ayçiçek & Yanpar Yelken, 2018), learning satisfaction and perceived learning (Lin, Wang, & Lee, 2022).

In order to effectively implement this model, the factors affecting its implementation are also of concern to educators. The studies by Villalba, Castilla, and Redondo (2018) showed the factors affecting the adoption of this model in technical and vocational education in developed countries in Europe.

In Vietnam, studies have focused on suggesting the process of adoption of this model combined with active teaching methods such as project-based learning using Google Classroom (Dung, 2015; Nga, 2019) or the process to organize FCM with Edmodo (Phuong & Anh, 2017) and the combination of the FCM with online teaching (Duy & Nhat, 2018). In addition, the authors also studied and applied the FCM in teaching various subjects to develop students' competence including teaching ecology in grades 12 (Duy & Nhat, 2018) an approach for translation studies (Nhat, 2021) and other subjects to develop students' creative thinking through digital teaching (Vu & Thanh, 2017) or to develop self-study competence (Phuong & Anh, 2017).

However, studies on factors affecting the implementation of FCM in the context of educational innovation in Vietnam have not been focused. In this study, we focus on analyzing the influencing factors for the organization of this model in general education in Vietnam. Research questions about the factors affecting the organization of FCM include:

Research question 1 (RQ1): To what extent do the school's facilities and infrastructure meet FCM implementation?

Research question 2 (RQ2): Which information communication technology (ICT) skills do teachers need to effectively apply FCM?

Research question 3 (RQ3): What kinds of training and support do teachers need to effect the adoption of the FCM?

Research question 4 (RQ4): At what level of readiness and awareness are teachers about the effectiveness of FCM?

Research question 5 (RQ5): What are the requirements of a learning management system needed for the FCM?

From these 5 research questions, we designed a questionnaire consisting of 17 questions of which 15 are Likert scale questions and the last two are open-ended questions.

2. Literature Review

Aaron Sam is one of the creators of the FCM for education with the aim of transferring in-class lecturers to record videos and spending classroom time for answering questions, discussion on students' misconceptions or in-depth problems and conducting experiments, hands-on activities or problem solving. This allows teachers to evaluate the effectiveness of their videos as well as increase time for classroom activities whereas the traditional method does not allow due to time constraints. Furthermore, the teacher acts as a facilitator to guide, support, encourage and give feedback on the student's performance (Bergmann & Sams, 2012).

The first definition of FCM was simply "events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa" (Lage, Platt, & Treglia, 2000). With an approach based on the theories of Grasha and Riechmann (1974); Keirsey and Bates (1984) and Kolb (1981), Lage et al. (2000) provided various options for students in their learning process and allowed them to choose the best suitable method to achieve their learning outcomes. Students were required to watch lecture videos in their preferred time outside class through a variety of information channels such as electronic lectures with attached recorded audio or printed materials in the lab or at home. In class, students spent their time to discuss prepared relevant material and

questions related to the watched lectures to practice, to do experiments and to apply knowledge through collaborative activities in class (Lage et al., 2000).

According to Walvoord and Anderson (2011); McDaniel and Caverly (2010), in comparison with the traditional model, class time is used to process information and apply knowledge with the teacher's guidance and peers' collaboration. According to these authors, an important feature of FCM is the enhancement of contact and interaction between teachers and students or between students. It is a combination of direct teaching and constructivism learning, creating the opportunity to personalize the learning process rather than replacing the teacher with videotape. Additionally, FCM has significant meaning in developing students' cognitive competence as activities to develop low-level thinking (remember, understand) are performed at home while students are guided and supported to carry out in-class activities that help develop higher-order thinking (apply, analyze, evaluate) Brame, 2013; Çevikbaş & Argün, 2017. Nevertheless, FCM is meaningful in developing communication and cooperation competence through self-study and group activities (Davies, Dean, & Ball, 2013); (Wang, 2017) and supporting learners with different learning styles (Goedhart, Blignaut-van Westrhenen, Moser, & Zweekhorst, 2019); (Halili, Sulaiman, Sulaiman, & Razak, 2019); (Afrilyasanti, Cahyono, & Astuti, 2016). In terms of participation in the learning process, students can be active in problem solving and assessing their learning by interacting with each other, identifying gaps in their learning process and developing critical thinking through discussion and gaining knowledge (Taylor & Statler, 2014). Bishop and Verleger provided an expanded definition of FCM emphasizing group activities and problem solving in class along with practice activities and solving closed-ended questions with the support of ICT. Accordingly, the FCM includes two parts: interactive group activities in class and direct individual instruction on computers outside the classroom. The authors also present the theoretical framework of FCM which is the psycho-educational origin of student-centered teaching. In other studies, the FCM has been described as a form of blended learning (Abeysekera & Dawson, 2015; Çevikbaş & Argün, 2017) and a combination of online and face-to-face teaching. Çevikbaş and Argün (2017) have presented that FCM can be defined as "a blended learning model in which meaningful and active learning activities involving metacognitive activities are carried out as a part of cooperative and individual work in classroom settings and in which low cognitive activities and independent studies in accordance with the individual's learning speed are carried out outside of school settings through utilization of class videos, slides, articles and course notes on digital platforms". However, according to the FCM proponent, the use of ICT is not FCM and is being carried out synchronously with the development trend of education in the era of science and technology development, helping students have diverse ways to access the teacher's lectures before coming to class through different devices (phones, laptops, etc.) and different ways (reading materials, printed materials, websites, etc.). This helps teachers conveniently connect to students anytime, increasing the cooperation and interaction of students (Johnson & Renner, 2012). Besides ICT application in teaching, the FCM also includes other characteristics such as: creating opportunity for learners to access the lesson content beforehand, encouraging learners to prepare through questions and exercises, conducting formative assessment on students' performance and designing in-class activities at a higher cognitive level involving active learning, problem solving or peer learning. This helps learners learn deeply to develop metacognitive processes and to implement cooperative learning strategies at the higher education level (Vliet, Winnips, & Brouwer, 2015).

According to Reidsema, Kavanagh, Hadgraft, and Smith (2017), students are required to participate in online learning activities to prepare for collaborative learning activities in class with their teachers and classmates. These activities are directly related to the content or teaching activities that will be held in class. Online and face-to-face teaching activities are designed to connect the activities of students and teachers. The activities are designed into a series of stories with related details so that students can participate in the learning process and master knowledge. Studies on the FCM also focus on describing students' classroom group activity and individual instruction at home through computers (Bishop & Verleger, 2013) or on analyzing the level of cognitive development through two stages: at home (access to knowledge) and in class (analysis, synthesis, evaluation and problem solving) (Brame, 2013) or attach FCM to peer instruction which emphasizes that the in-class learning process includes conceptual questions that require students to answer to collect results in class. Teacher will use questions with a clear difference between the wrong and right groups to help them realize their mistakes and get novel knowledge while doing group activities involving deep learning to improve students' interaction with teachers and classmates as well as enhance their knowledge in a deeper way (Mazur, 1997).

The invention of the learning process is a basic characteristic that distinguishes FCM from other forms of b-learning. To apply the FCM, it is necessary to meet requirements on facilities, ICT infrastructure and the basic ICT skills of teachers and students. The FCM can be applied to different levels, subjects and topics (Bishop & Verleger, 2013; Giannakos, Krogstie, & Chrisochoides, 2014). In terms of the role of the FCM in the development of students' perception and performance, Davies and his colleagues based their constructivism theory on the interaction between students and teachers or their peers during out-side class time and the development of cooperative competence through in-class group activities with active learning activities that require students to collaborate and cooperate in a diverse learning environment (Davies et al., 2013). In terms of knowledge formation, the FCM allows students to study at their own pace with a suitable plan to reduce cognitive load and to maximize retention, to optimize concentration, to increase time doing tasks due to preparation and to study with adjustments according to individual needs and learning styles (Afrilyasanti et al., 2016; Gallagher, 2009; Gannod et al., 2008; Goedhart et al., 2019; Halili et al., 2019). The FCM also allows students to actively study (Du, Fu, & Wang, 2014) and develop self-study competence in a flexible and favorable environment that allows them to learn anywhere and anytime (Kadry & El Hami, 2014). As a result, students with different comprehension and perception levels can keep up with the lecture and in-class activities by autonomously arranging their learning progress at their own pace and style (Phuong & Anh, 2017) through active participation and better interaction with teachers' classroom lectures, promoting students' learning motivation (He, 2020; Zainuddin & Halili, 2016).

To effectively adapt FCM, Liu, Ripley, and Lee (2016) analyzed factors from the literature affecting the success of FCM adoption including overall design, design of information, design of technology use, active learning, motivation, special guidance and self- regulated learning in teaching calculus. Villalba et al. (2018) conducted a survey on teachers of Erasmus+ project schools in the EU to analyze factors affecting the FCM in vocational

training. Wang (2017) analyzed difficulties and barriers for teachers including external factors such as facilities, training, school support and internal factors including the teacher's fear of change, restriction on confidence and belief in teaching methods. However, research on affecting the FCM implementation of teachers in the era of technology revolution 4.0 in Vietnam is still an issue. This study focused on factors through a survey of teachers trained in higher education providing a deep insight into how to apply the FCM theory in a real-life teaching situation.

3. Research Method

The study focused on teachers' perceptions of the roles of teachers and students in the FCM, their attitude and readiness to adapt it as well as the requirements on ICT facilities and competence necessary to implement the FCM in the direction of competence-oriented teaching and learning in the current education context in Vietnam. Qualitative and quantitative analyses were conducted. The questionnaire included two parts: an initial section explaining the goal of the study and collecting anonymous demographic data and another section with questions based on the previously defined hypothesis. In the second part of the questionnaire, there are two open-ended questions providing qualitative data on context information, reasons, in-depth research or the participant's perspective and fifteen Likert questions that provide quantitative data. To design the content of the survey, we based it on the research results of published works related to the use of technology in combination with active teaching methods inside and outside the classroom. The results showed that teachers' ICT competence, pedagogical methodology, professional competence, regular training to improve qualifications and a positive attitude and readiness for innovation are internal factors while the appropriate ICT infrastructure of the school, teachers and especially students are external factors that determine the success of the implementation of FCM.

The participants of the survey in this study are teachers who are being trained with the FCM in the training modules of the University of Education in Danang, Vietnam. They are the first recipients of this model and provide opinions on the possibilities and requirements for effective implementation of the FCM in teaching practice at high schools with the aim of developing students' competencies. This is also a premise for higher education institutions to organize training pedagogical students, providing theory and a practical basis for applying this model. The content of the survey focused on teachers' awareness of the benefits of FCM, teachers' readiness, requirements for ICT skills, the training needed to improve their qualifications and the school's infrastructure conditions, responsiveness and ICT support in implementing this model.

4. Results

The survey collected a total of 351 answers from teachers. Table 1 shows the demographic profile of participants based on their educational level and residential area. As shown in Table 1, out of those 351 participants, the majority are teachers in secondary schools (83.76%) whereas in terms of teaching area those are in Central and Southern Vietnam.

Table 1. presents the demographic profile of participants by residential area and educational level.

Participants	Central		South		Highland		Ratio
Primary	12/181	6.63%	1/141	0.71%	5/29	17.24%	5.13%
Secondary	144/181	9.56%	135/141	95.74%	15/29	51.72%	83.76%
High school	17/181	9.39%	5/141	3.55%	9/29	31.03%	8.83%
Higher education	8/181	4.42%	0	0	0	0	2.28%
Ratio	51.57%		40.17%		8.26%		100%

Table 2 shows the demographic profile of participants by gender, degree and seniority. Table 2 shows that female teachers had the highest proportion of participation (69.5%) while 95.7% of respondents have bachelor's degrees. Out of 351 teachers surveyed, 92.61% are teaching in middle and high schools with bachelor's degrees. The small parts that remain are lecturers who are working at higher educational institutions with a master's degree or higher. It is interesting that the surveyed teachers have seniority in teaching and education with 65.53% (230 of 351) having 10-25 years of teaching experience and 13.11% having more than 25 years of teaching experience.

Table 2. presents the demographic profile of participants by gender, degree and seniority.

Participants		Quantity	Ratio
Gender	Male	107	30.5%
	Female	244	69.5%
Degree	Bachelor	336	95.7%
	Master	8	2.3%
	Doctor	4	1.1 %
	Associate professor/Professor	3	0.9 %
Working seniority	1-10 Years	75	21.37%
	10 – 20 Years	177	50.43%
	20-25 Years	53	15.10%
	More than 25 years	46	13.11%

4.1. Validity and Reliability

We used the interval ratio which is a special kind of ordinal ratio because it shows the distance between the variables. This ratio is used to consider the median, mode, range, mean and standard deviation. After downloading survey data from Google Form, the data was saved in an Excel file in Word format and encoded into numbers and cleaned before being entered into Statistical Package for the Social Sciences (IBM SPSS) version 20 for analysis. We used IBM SPSS Statistics version 20 to analyze reliability and construct validity. We selected and classified questions according to research questions to analyze each factor. In each research question, reliability was our first

focus. The consistency's reliability was tested using Cronbach's alpha coefficient and the corrected total correlation. It is important to use the corrected item-total correlation in evaluating the contribution of each item to the total ratio. If the corrected item- total correlation is less than 0.3, the observed variable should be removed because this coefficient indicates the possibility of a close correlation between the observed variable and the remaining variables in the same ratio. After analyzing by SPSS for each observed variable in each question, the results show that all observed variables have item-total correlations above 0.3 (the lowest is 0.468 for the variable on the level of proficiency in using common teaching software such as Word, Excel, etc.). However, this correlation coefficient is larger than 0.3, so we still keep it in the analysis.

Next, the Cronbach's alpha was calculated for each dimension to verify if the observed variables in each factor are reliable or not. It shows the degree of close correlation between observed variables in the same factor and finds out which observed variable does not contribute to the factor measurement. If the value of Cronbach's alpha is greater than 0.8, it means that the ratio is being used very well. The research questions were conducted with a Cronbach's alpha coefficient in the range of 0.818 to 0.971 demonstrating that the designed questions have high reliability in collecting responses from teachers and effectively organizing the FCM.

Table 3 presents Cronbach's alpha and KMO for each research question.

Table 3. exhibits Cronbach's alpha and KMO for each research question.

No.	Content	KMO	Bartlett's test of sphericity	Cronbach's alpha
RQ1	The level of satisfaction with the school's facilities to adapt FCM	0.93	Sig. 0 Df 28 Chi-square 2698	0.95
RQ2	Teacher's needs in developing their ICT skills to effectively adapt FCM	0.953	Sig. 0 Df 45 Chi-square 4358	0.971
RQ3	Teacher's needs in supporting the teaching process	0.961	Sig. 0 Df 276 Chi-square 8882	0.968
RQ4	The level of the teacher's readiness	0.853	Sig. 0 Df 15 Chi-square 2240	0.941
RQ5	The requirements of a learning management system	0.957	Sig. 0 Df 120 Chi-square 6317	0.973

4.2. Mapping the Relationship between Research Questions

In this study, two important factors were surveyed: the competence of teachers and the basic conditions of the school. The teacher's competencies include professional competence, ICT skills, teaching and assessment methods, the student's learning process management capacity and the teacher's readiness attitude when organizing the FCM while the need to develop necessary ICT skills in the processes of teaching, assessment and student management is considered in RQ2, teachers' positive attitudes and readiness are analyzed in RQ4. For schools, infrastructure conditions, facilities and learning management systems (LMS) as well as training programs to improve teachers' competence are factors to be considered. While RQ1 and RQ5 refer to the responsiveness of schools in terms of facilities, infrastructure and LMS, RQ3 is concerned with programs that foster the necessary competencies for the teachers listed above.

Figure 1 illustrates the relationship between factors and sub-factors related to each research question.

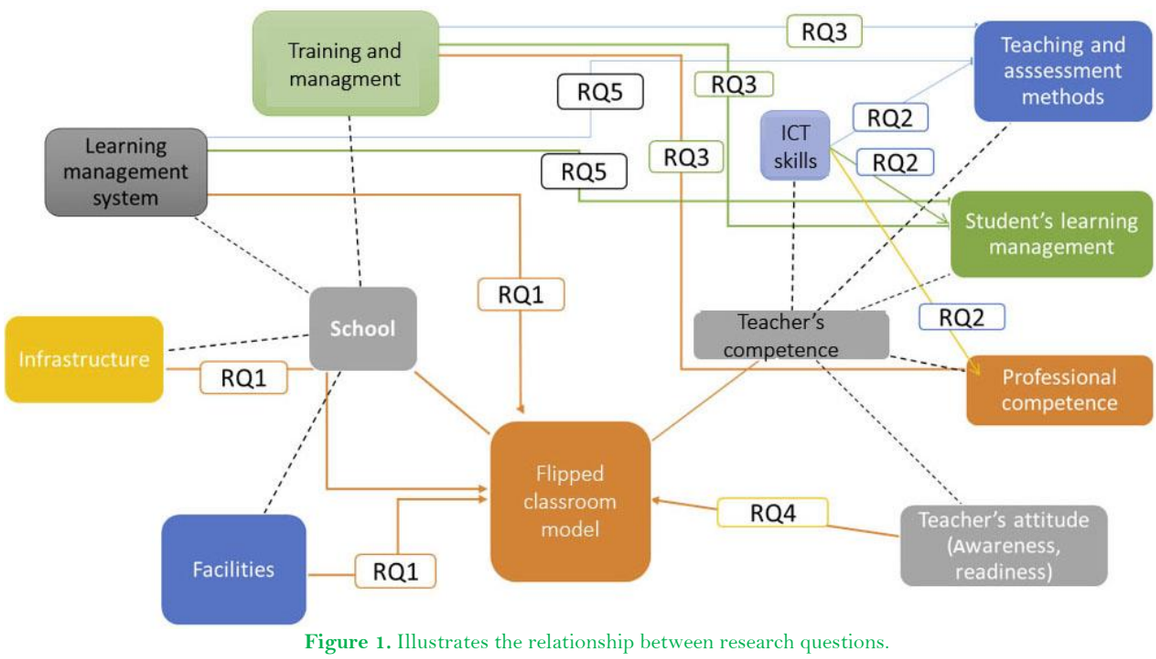

Figure 1. Illustrates the relationship between research questions.

4.3. Factors Affecting the Adoption of the FCM

4.3.1. Teacher's Responses on Factors Affecting the Quality of Implementation of the FCM

In question 16 of the survey: "In order to effectively adapt the FCM, in your opinion, what factors determine the training quality"? We obtained opinions and classified them in the following table: Table 4 presents teachers' perceptions on factors affecting the FCM's adaptation.

Table 4 presents teachers' opinions on factors affecting the FCM's adaptability.

Opinion	Ratio
Training teachers on ICT skills in using online teaching software, designing video lectures using e-learning system	12/351
School's infrastructure, facilities, network and transmission conditions	98/351
Information technology in teaching, online teaching software	13/351
Student-teacher interaction	19/351
Student's awareness	115/351
Professional competence and ICT skills of the teacher	136/351
Teaching content	5/351
Teaching methods and approaches	34/351

Table 4 shows factors affecting the FCM include: the school's infrastructure, facilities, network and transmission conditions information technology in teaching (98/351), competence of teachers (including professional competence, ICT skill, teaching methods and teaching content) (175/351), student-teacher interaction (19/351)and the student's awareness of self-study (115/351). According to the above opinions, factors chosen to analyze about their effect on adoption the FCM includes: *schools* (infrastructure and technology facilities, conditions to teach and manage learning processes, fostering and training teachers), a teacher's *competence* (expertise, teaching methods, organization of teaching, student management, ICT skill) and *student conditions* (self-study, ICT condition, self-study awareness of students).

4.3.2. A Teacher's Perception of the Benefits of the FCM in the Teaching and Learning Process

Items in question 15 provided data for RQ4 related to their awareness of the benefits of FCM and the purposes of applying it. Data were analyzed by International Business Machines (IBM) SPSS Statistics version 20 and presented in a descriptive summary in Table 5. Table 5 shows descriptive statistics on teachers' perceptions of the benefits of the FCM.

Table 3. Introduces descriptive statistics on teachers' perceptions of the benefits of the FCM.

Opinion	N	Minimum	Maximum	Mean	Std. deviation
15.1. Increasing self-study time	351	2	5	4.05	0.646
15.2. Transferring the task of learning novel knowledge at home to students	351	2	5	4.10	0.606
15.3 Increasing time to guide students to solve a variety of problems from easy to difficult	351	2	5	4.09	0.615
15.4 Increasing time for group activities, discussions and project implementation	351	2	5	4.03	0.680
15.5 Organizing a STEM project	351	1	5	3.93	0.786
15.6. Taking in-class time to practice, apply and widen knowledge	351	2	5	4.04	0.658
15. Assessing the general and specific competence of students	351	2	5	4.05	0.650
15.8 Formative assessment	351	2	5	3.99	0.674
Valid N (List wise)	351				

As shown in Table 5, teachers realized that the FCM brings positive benefits to the teaching process such as increasing self-study time, organizing group activities, discussions or projects, organizing STEM teaching, increasing in-class time for higher-order thinking activities such as analysis and application and assessing students' competence through formative assessment. The mean of each item ranges from 3.93 to 4.10 with a standard deviation between 0.606 and 0.786 showing a high degree of teacher perception on the benefits of the FCM.

Table 6. Presents Cronbach's alpha of question 15.

Opinion	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Squared multiple correlation	Cronbach's alpha if item deleted
15.1	28.23	15.106	0.765	0.684	0.925
15.2	28.18	15.207	0.801	0.722	0.922
15.3	28.19	15.201	0.789	0.735	0.923
15.4	28.25	14.806	0.783	0.650	0.923
15.5	28.35	14.435	0.722	0.573	0.929
15.6	28.24	15.154	0.737	0.572	0.927
15.7	28.23	14.998	0.783	0.697	0.923
15.8	28.29	14.817	0.788	0.710	0.923

Table 6 shows the Cronbach's alpha for question 15. The Cronbach's alpha of this question is 0.935 showing that the question has a high reliability of 93.5% and there is no benefit to be removed to increase the reliability of the scale because the Cronbach's alpha of an item deleted is not higher than 0.935. Furthermore, the Kaiser-Meyer-Olkin (KMO) coefficient is used to measure how well-suited data is for factor analysis with the condition of being

greater than 0.5 and the sig. value of the Bartlett's test <0.05. This shows that the observed variables are correlated with each other. In this question, the KMO coefficient is 0.920 and the sig. of Bartlett's test is 0.000 showing that the results have reliability and validity and that the factors are correlated with each other. Spearman's rho correlation was applied to determine the relationship between these benefits. Table 7 shows that these benefits are strongly correlated with each other (the correlation coefficient ranges from 0.588 to 0.811) and statistically significant (sig. (2-tailed) – 0.000<0.05).

Table 7. Exhibits spearman's rho correlation.

Opinion			15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8
Spearman's rho	15.1	Correlation coefficient	1.000							
		Sig. (2-tailed)	.							
	15.2	Correlation coefficient	0.811**	1.000						
		Sig. (2-tailed)	0.000	.						
	15.3	Correlation coefficient	0.788**	0.787**	1.000					
		Sig. (2-tailed)	0.000	0.000	.					
	15.4	Correlation coefficient	0.736**	0.729**	0.743**	1.000				
		Sig. (2-tailed)	0.000	0.000	0.000	.				
	15.5	Correlation coefficient	0.632**	0.619**	0.593**	0.689**	1.000			
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	.			
	15.6	Correlation coefficient	0.595**	0.643**	0.627**	0.629**	0.702**	1.000		
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	.		
	15.7	Correlation coefficient	0.638**	0.692**	0.629**	0.651**	0.726**	0.702**	1.000	
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	.	
	15.8	Correlation coefficient	0.628**	0.653**	0.588**	0.614**	0.724**	0.715**	0.823**	1.000
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	.

Note: **. Correlation is significant at the 0.01 level (2-tailed).

4.3.3. Teacher's ICT Skills Needed to Adapt the FCM

Based on the characteristics of the FCM and elements of the teaching process, teachers need to foster ICT skills such as designing video lectures (S12.1), online teaching methods (S12.2), online feedback and surveys (S12.3) searching documents for designing lectures (S12.4), designing PowerPoint lectures (S12.5), interacting with students in online teaching (S12.6), assessment and evaluation of the student's learning process (S12.7), designing interactive games (S12.8), designing video lectures (S12.9), designing online competence-based test (S12.10), classroom organization and management (S12.11), using online testing software (S12.12), organizing online discussion and sharing activities (S12.13) and management of student's portfolio (S12.14). These skills were divided into groups involving: supporting the design of attractive lesson content, encouraging students' participation and motivation (S12.1, S12.4, S12.5, S12.8, S12.9), modern teaching methods (S12.2), increasing student-teacher interaction in the FCM (S12.6, S12.8, S12.13), managing students' learning processes (S12.3, S12.11, S12.14) and assessment and evaluation of the students' learning processes (S12.7, S12.10, S12.12).

The analysis results showed that the average value of each skill ranges from 4.13 to 4.23 showing the high degree of teacher agreement on the ICT skills needed to be trained to help them organize the FCM. Table 8 shows the teacher's level of agreement with each skill and gives evidence for RQ2.

Table 8. exhibits the teacher's level of agreement on ICT skills.

	Strongly disagree	Disagree	Normal	Agree	Strongly agree	Mean	Std. deviation
S12.1	1	3	29	207	111	4.21	0.645
S12.2	0	5	29	201	116	4.22	0.651
S12.3	0	3	41	213	94	4.13	0.634
S12.4	1	4	33	189	124	4.23	0.684
S12.5	1	7	31	193	119	4.20	0.702
S12.6	0	4	30	199	118	4.23	0.645
S12.7	1	3	36	197	114	4.20	0.671
S12.8	1	3	35	206	106	4.18	0.657
S12.9	1	2	32	197	119	4.23	0.654
S12.10	1	3	34	191	122	4.23	0.674
S12.11	1	2	41	197	110	4.18	0.670
S12.12	1	2	29	205	114	4.22	0.638
S12.13	1	1	44	199	106	4.16	0.663
S12.14	1	4	40	210	96	4.13	0.666

An independent sample T-test was applied to test the equality of the mean values of factors related to ICT skills needed to be trained to adapt the FCM of the two genders. Both male and female teachers have the same need to develop ICT skills to adapt the FCM.

If the Sig value in the Levene test is < 0.05, the variances of the two gender groups are different. We use the T-test results in the equal variances not assumed section and vice versa. If the sig value in the t-test is < 0.05, it shows that there is a significant difference in mean between the two independent groups. Table 9 presents the result of an independent sample T-test. According to Table 9 for the skills of online feedback and survey (S12.3), searching documents for designing lectures (S12.4), classroom organization and management (S12.11), using online test software (S12.12) and organizing online discussion and sharing activities (S12.13). There was no significant difference in the mean values of the two genders.

Table 9. Exhibits independent samples test.

Opinion		Levene's test for equality of variances		T-test for equality of means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean difference	Std. error difference	95% confidence interval of the difference	
									Lower	Upper
S12.1	Equal variances assumed	0.102	0.750	-2.031	349	0.043	-0.151	0.075	-0.298	-0.005
	Equal variances not assumed			-1.889	172.848	0.061	-0.151	0.080	-0.309	0.007
S12.2	Equal variances assumed	0.059	0.808	-2.236	349	0.026	-0.168	0.075	-0.315	-0.020
	Equal variances not assumed			-2.112	178.388	0.036	-0.168	0.079	-0.324	-0.011
S12.3	Equal variances assumed	2.160	0.143	-.974	349	0.331	-0.072	0.074	-0.216	0.073
	Equal variances not assumed			-1.004	217.186	0.317	-0.072	0.071	-0.212	0.069
S12.4	Equal variances assumed	0.237	0.627	-1.938	349	0.053	-0.153	0.079	-0.308	0.002
	Equal variances not assumed			-1.797	171.798	0.074	-0.153	0.085	-0.321	0.015
S12.5	Equal variances assumed	0.067	0.797	-2.945	349	0.003	-0.237	0.081	-0.396	-0.079
	Equal variances not assumed			-2.707	168.735	0.007	-0.237	0.088	-0.410	-0.064
S12.6	Equal variances assumed	0.689	0.407	-2.422	349	0.016	-0.180	0.074	-0.326	-0.034
	Equal variances not assumed			-2.357	190.246	0.019	-0.180	0.076	-0.331	-0.029
S12.7	Equal variances assumed	1.521	0.218	-2.443	349	0.015	-0.189	0.077	-0.341	-0.037
	Equal variances not assumed			-2.340	183.732	0.020	-0.189	0.081	-0.348	-0.030
S12.8	Equal variances assumed	6.743	0.010	-2.652	349	0.008	-0.200	0.076	-0.349	-0.052
	Equal variances not assumed			-2.638	199.829	0.009	-0.200	0.076	-0.350	-0.051
S12.9	Equal variances assumed	0.343	0.558	-2.753	349	0.006	-0.207	0.075	-0.355	-0.059
	Equal variances not assumed			-2.598	178.041	0.010	-0.207	0.080	-0.364	-0.050
S12.10	Equal variances assumed	0.477	0.490	-2.438	349	0.015	-0.189	0.078	-0.342	-0.037
	Equal variances not assumed			-2.311	179.769	0.022	-0.189	0.082	-0.351	-0.028
S12.11	Equal variances assumed	0.394	0.531	-1.544	349	0.124	-0.120	0.078	-0.272	0.033
	Equal variances not assumed			-1.494	187.957	0.137	-0.120	0.080	-0.278	0.038
S12.12	Equal variances assumed	0.121	0.728	-1.598	349	0.111	-0.118	0.074	-0.263	0.027
	Equal variances not assumed			-1.504	176.992	0.134	-0.118	0.078	-0.273	0.037
S12.13	Equal variances assumed	0.291	0.590	-1.644	349	0.101	-0.126	0.077	-0.277	0.025
	Equal variances not assumed			-1.578	184.521	0.116	-0.126	0.080	-0.284	0.032
S12.14	Equal variances assumed	0.069	0.793	-2.227	349	0.027	-0.171	0.077	-0.322	-0.020
	Equal variances not assumed			-2.098	177.337	0.037	-0.171	0.082	-0.332	-0.010

The factors S12.1, S12.2, S12.5, S12.6, S12.7, S12.8, S12.9, S12.10 and S12.14 have significant differences in the mean value average of the two genders. These skills are mainly related to the design of video or PowerPoint lectures taking into account aesthetics, interaction, integrating games to attract students' attention, online teaching methods and managing the learning process of students. The survey showed that teachers appreciate the influence of factors such as teaching methods, ICT application in the design and organization of the teaching process, assessment of students ' competence and managing students' learning processes.

4.3.4. Requirements for the Learning Management System

One of the teachers' concerns when organizing FCM is how to design the LMS to provide students with video lectures beforehand and organize a variety of out-class learning activities. Items of question 13 mentioned the essential elements of a LMS in order to achieve expected learning outcomes through the FCM and the data were presented in Table 10 providing evidence for RQ5. Table 10 shows the item-total statistics.

Table 10. Presents item-total statistics.

Cronbach's alpha: 0.972					
	Scale mean if item deleted	**Corrected item-total correlation**	**Mean**	**Std. deviation**	**Cronbach's alpha if item deleted**
13.1. Simple interface	59.62	0.718	4.12	0.696	0.971
13.2. Easily access	59.82	0.699	3.93	0.766	0.972
13.3. Linked account	59.86	0.676	3.88	0.856	0.972
13.4. Flexible time	59.79	0.850	3.96	0.724	0.970
13.5. Diversity lecture	59.71	0.853	4.04	0.732	0.970
13.6. Combination various teaching methods	59.83	0.809	3.92	0.787	0.970
13.7. Variety of devices	59.64	0.875	4.11	0.702	0.969
13.8. Cloud computing	59.86	0.841	3.88	0.800	0.970
13.9. Integration of virtual reality	59.87	0.802	3.88	0.837	0.970
13.10. Test analysis	59.75	0.855	4.00	0.758	0.969
13.11. Learning data analysis	59.70	0.875	4.05	0.695	0.969
13.12. Lecture privacy	59.70	0.813	4.04	0.808	0.970
13.13. Student's learning management	59.72	0.865	4.03	0.772	0.969
13.14. Virtual assistant	59.85	0.810	3.90	0.788	0.970
13.15. Integration digital material	59.75	0.864	4.00	0.748	0.969
13.16. Formative score management	59.74	0.880	4.01	0.743	0.969

The survey results showed that teachers appreciate factors such as a simple, friendly and easy-to-use interface (13.1), diversified lectures, combining presentations with sound, images and games (13.5) test data analysis (13.10), the ability to analyze learning data including interactions, self-study time, formative scores of students (13.11, 13.13, 13.16) so that teachers can have solutions to support students in improving their learning achievement. These factors are highly agreed upon with the average value above 4.00. Additionally, factors related to technical and technological requirements such as easy connection (13.2), using the same account for connection (13.3), flexible learning time (13.4), cloud computing (13.8), integrating virtual reality technology to support practice (13.9) and integrating a virtual assistant (13.14) have an average value between 3.88 and 3.93. The Cronbach's alpha was 0.972 and no factors were removed to increase the reliability of the question.

4.3.5. Factors Affecting the Use of LMS in the Teaching Process

After analyzing the essential elements of a LMS, we asked teachers' opinions on the factors affecting their decision to use a LMS in teaching. The results of the analysis were collected from the data in question 6 of the questionnaire and presented in Table 11 which shows item-total statistics on elements of a LMS.

Table 11. presents item-total statistics.

Cronbach's alpha: 0.913					
	Scale mean if item deleted	**Corrected item-total correlation**	**Mean**	**Std. deviation**	**Cronbach's alpha if item deleted**
School's policy	25.74	0.572	2.91	1.113	0.913
Infrastructure	24.81	0.783	3.84	0.850	0.888
Learning content	25.13	0.716	3.52	0.755	0.894
ICT skill	24.83	0.749	3.82	0.812	0.891
Students learning style	24.92	0.773	3.73	0.783	0.889
Investment cost	24.98	0.674	3.67	0.855	0.897
Class size	25.14	0.674	3.51	0.814	0.897
School's academic management	25.00	0.765	3.65	0.800	0.890

The Cronbach's alpha of this question is 0.913 showing that the question has reliability. According to the data, the influence level of factors related to infrastructure (facilities, equipment), learning content and subject characteristics, teachers' ICT skills, the learning styles of learners and the class size and academic management of the school are assessed with an average value of 3.51 to 3.84. The policy of support and encouragement from the school also contributed to a level of agreement of 2.91.

4.3.6. The School's Condition in Adapting the FCM

In order to effectively adapt the FCM, the conditions of facilities, equipments, the network system as well as the school's management, fostering and support policies are also factors. The questions 8 and 10 in the

questionnaire allowed for the collection of opinions on the responsiveness of infrastructure and the necessity of supporting activities at school that are related to RQ1.

Question 8 highlighted the school's infrastructure, including: 1. Internet-connected computers for online teaching. 2. Classrooms for online teaching. 3. A synchronous technology system for teaching. 4. Learning management system. 5. Lab to support recording video lectures or experiments. 6. Technical support team. 7. Teaching software and technology. 8. Competence-based assessment system.

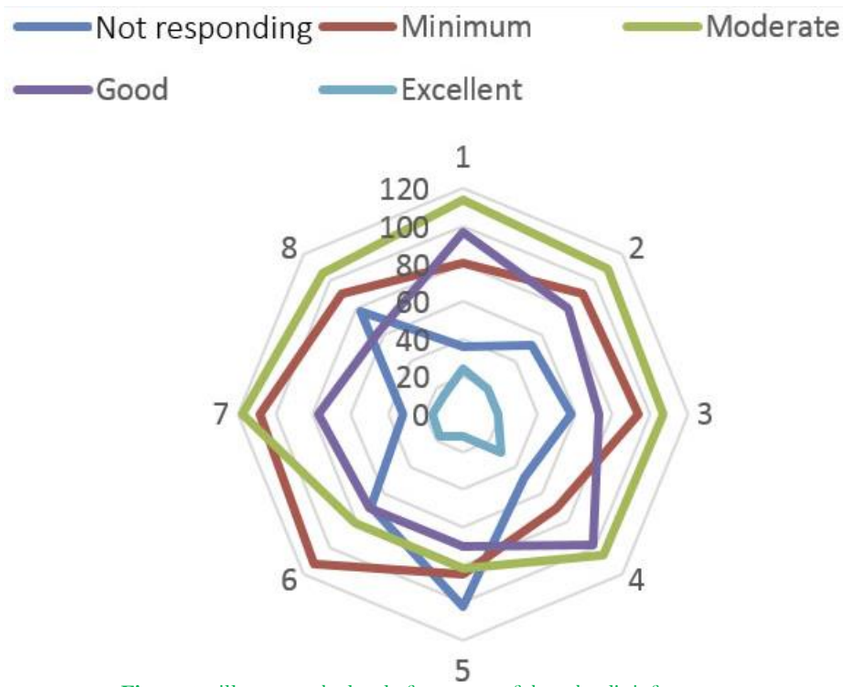

Figure 2. illustrates the level of response of the school's infrastructure.

Figure 2 demonstrates the level of response of the school's infrastructure. As can be seen from Figure 2, a significant majority of votes belonged to minimum and moderate while the number of votes for excellent made up a minor proportion. The highest quantity of not responding belonged to lab support for recording video lectures or experiments (5) Competence-based assessment system (8) with 102 and 77 responses respectively. Otherwise, factors 1 (internet-connected computers for online teaching) and 4 (the learning management system) received a large amount of good response with 97 and 98 votes respectively.

Question 10 mentioned the teacher's needs for the school's support in activities such as: 1. Providing regulations on online teaching. 2. Commendation and encouragement. 3. The finance support policy. 4. Implementing a synchronous and unified technology platform. 5. Providing timely technological solutions during implementation. 6. Training on teaching methods. 7. Training on ICT applications in teaching. 8. Documents guiding the adoption of FCM. 9. A learning data storage system. 10. Allocate time for online learning. The data on the level of necessary school support activities presented in Figure 3.

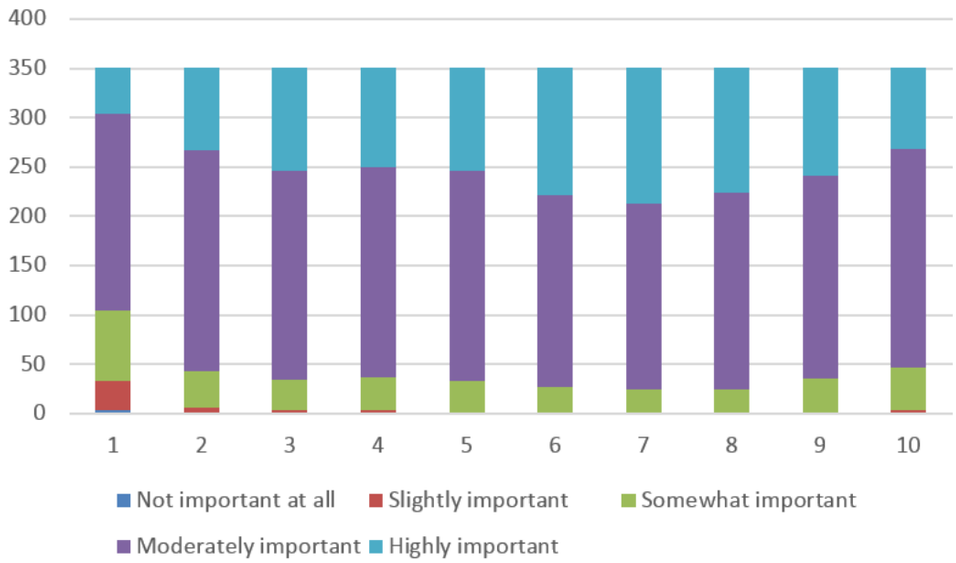

Figure 3. illustrates the level of necessary of support activities at school.

Teacher's attitude and readiness in participating in training courses from the school to adapt FCM which are mentioned in RQ5 were presented in question 14. The main courses mentioned include: 1. An introduction to LMS. 2. Guidance on how to use LMS. 3. ICT applications in teaching. 4. Guidance for self-study to implement LMS. 5. Discussion and sharing to develop lectures. 6. Suggestions, feedback for improvement. Figure 4 presents a descriptive summary of the teacher's attitude and readiness to attend a training course. The figure shows a high proportion of teachers who agree to attend training courses to improve their skills in teaching FCM.

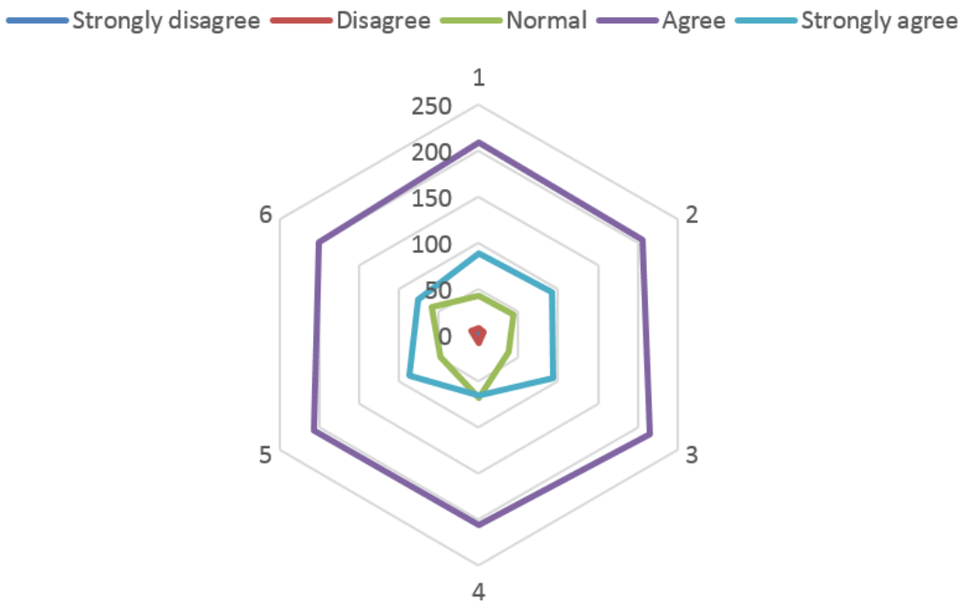

Figure 4. demonstrates the teacher's attitude and readiness to attend a training course.

5. Discussion

From the above data, it is shown that teachers' perceptions of the benefits of adoption of the FCM, teachers' ICT skills, the requirements of the LMS, the school's infrastructure and facilities as well as training courses enhancing teachers' pedagogical and professional competence are factors affecting the implementation of the FCM in real teaching situations. Teacher's perceptions on guidance, process and benefits of the FCM caused a change in their mindset on applying teaching methods in a flexible learning environment, bring students an effective learning process. With the inversion of the teaching and thinking processes, factors affecting the FCM are related to teachers' skills related to combining teaching and assessment methods, learning process management and designing interactive learning activities. Combined with the development of ICT skills, LMS with an attractive interface, interactive videos and tests is an active support tool for the FCM. Nevertheless, the school's infrastructure, facilities, support policies and students' learning culture are the factors to take into account. Schools need facility equipment and technology to design noticeable video lectures that meet technical requirements as well as solutions to integrate the features of LMS to assess students' competence. Finally, to encourage teachers to implement the FCM, it is necessary to have comprehensive support policies including issuing sanctions to encourage teachers, developing and managing the synchronous LMS and facilities and providing training on teaching and assessment methods.

In training pedagogical students, higher education institutions need to pay attention to the implementation of teaching methods to support FCM, develop ICT skills to organize FCM and create conditions for students to practice this model at school so that they have the opportunity to implement it in a real situation.

References

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

Afrilyasanti, R., Cahyono, B. Y., & Astuti, U. P. (2016). Effect of flipped classroom model on Indonesian EFL students' writing ability across and individual differences in learning. *International Journal of English Language and Linguistics Research, 4*(5), 65-81.

Aliye, K.-I., Jaramillo Cherrez, N., & Jahren, C. T. (2018). A systematic review of research on the flipped learning method in engineering education. *British Journal of Educational Technology, 49*(3), 398-411. https://doi.org/10.1111/bjet.12548

Ayçiçek, B., & Yanpar Yelken, T. (2018). The effect of flipped classroom model on students' classroom engagement in teaching English. *International Journal of Instruction, 11*(2), 385-398.

Bergmann, J., & Sams, A. (2012). *Flip your classrooom Reach every student in every class every day.* The United States of America: International Society for Technology in Education.

Bishop, J. L., & Verleger, M. A. (2013). *The flipped classroom: A survey of the research.* 2013 ASEE Annual Conference & Exposition, Atlanta, Georgia.

Brame, C. (2013). Flipping the classroom. Vanderbilt University Center for Teaching. Retrieved from: http://cft.vanderbilt.edu/guides-sub-pages/flipping-the-classroom.

Çevikbaş, M., & Argün, Z. (2017). An innovative learning model in digital age: Flipped classroom. *Journal of Education and Training Studies, 5*(11), 189-200. https://doi.org/10.11114/jets.v5i11.2322

Danker, B. (2015). Using flipped classroom approach to explore deep learning in large classrooms. *IAFOR Journal of Education, 3*(1), 171-186. https://doi.org/10.22492/ije.3.1.10

Davies, R. S., Dean, D. L., & Ball, N. (2013). Flipping the classroom and instructional technology integration in a college-level information systems spreadsheet course. *Educational Technology Research and Development, 61*(4), 563-580. https://doi.org/10.1007/s11423-013-9305-6

Demski, J. (2013). 6 expert tips for flipping the classroom. *Campus Technology, 26*(5), 32-37.

Du, S. C., Fu, Z. T., & Wang, Y. (2014). *The flipped classroom advantages and challenges.* Paper presented at the International Conference on Economic Management and Trade Cooperation.

Dung, N. (2015). Research using flipped classroom model: Difficulties, challenges and applicability. *Educational Science, 60*(8), 85-92. https://doi.org/10.18173/2354-1075.2015-0258,85-92

Duy, P. D., & Nhat, N. V. (2018). Combination of reverse teaching and online teaching in Ecology, Biology 12. *Journal of Education and Training Studies, 435*(1), 44-48.

Gallagher, K. (2009). *From guest lecturer to assignment consultant: Exploring a new role for the teaching librarian.* Paper presented at the LOEX Conference Proceedings 2007.

Gannod, G. C., Burge, J. E., & Helmick, M. T. (2008). *Using the inverted classroom to teach software engineering.* Paper presented at the Proceedings of the 30th International Conference on Software Engineering. New York, NY: ACM.

Giannakos, M. N., Krogstie, J., & Chrisochoides, N. (2014). *Reviewing the flipped classroom research: Reflections for computer science education.* Paper presented at the The Computer Science Education Research Conference, New York, NY: ACM.

Goedhart, N., Blignaut-van Westrhenen, N., Moser, C., & Zweekhorst, M. (2019). The flipped classroom: Supporting a diverse group of students in their learning. *Learning Environments Research, 22*(2), 297-310. https://doi.org/10.1007/s10984-019-09281-2

Grasha, A. F., & Riechmann, S. W. (1974). A rational approach to developing and assessing the construct validity of a student learning style scales instrument. *The Journal of Psychology, 87*(2), 213-223. https://doi.org/10.1080/00223980.1974.9915693

Halili, S. H., Sulaiman, S., Sulaiman, H., & Razak, R. (2019). Exploring students' learning styles in using mobile flipped classroom. *International and Multidisciplinary Journal of Social Sciences, 8*(2), 105-125. https://doi.org/10.17583/rimcis.2019.4070

He, J. (2020). Research and practice of flipped classroom teaching mode based on guidance case. *Education and Information Technologies, 25*(4), 2337-2352. https://doi.org/10.1007/s10639-020-10137-z

Johnson, L. W., & Renner, J. D. (2012). *Effect of the flipped classroom model on a secondary computer applications course: Student and teacher perceptions, questions and student achievement.* University Louisville, Louisville: Unpublished Disseration.

Kadry, S., & El Hami, A. (2014). Flipped classroom model in calculus II. *Education, 4*(4), 103-107.

Kamaruddeen, A. M., & Nordin, N. (2019). Utilization of outdoor activity to improve non-science background students' understanding of science concepts. *American Journal of Social Sciences and Humanities, 4*(4), 528–534. https://doi.org/10.20448/801.44.528.534

Keirsey, D., & Bates, M. M. (1984). *Please understand me: Character & temperament types.* Del Mar, CA: Prometheus Nemesis.

Kinyaduka, B. D., Kalimasi, P. J., & Heikkinen, A. (2019). Developing responsibility for learning in higher education in Tanzania: Experiences from undergraduate programmes. *American Journal of Education and Learning, 4*(1), 62–69. https://doi.org/10.20448/804.4.1.62.69

Kolb, D. A. (1981). Learning styles and disciplinary differences. *The Modern American College, 1*, 232-235.

Kunz, R. (2013). *Flip and out: Turning the traditional classroom upside down.* Las Vegas: Jo Mackey Academy of Leadership and Global Communication.

Lage, M. J., Platt, G. J., & Treglia, M. (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. *The Journal of Economic Education, 31*(1), 30-43. https://doi.org/10.2307/1183338

Lin, G.-Y., Wang, Y.-S., & Lee, Y. N. (2022). Investigating factors affecting learning satisfaction and perceived learning in flipped classrooms: The mediating effect of interaction. *Interactive Learning Environments*, 1-22. https://doi.org/10.1080/10494820.2021.2018616

Liu, L., Ripley, D., & Lee, A. (2016). Flipped learning and influential factors: Case analysis. *Journal of Educational Technology Development and Learning, 9*(2), 5. http://doi.org/10.18785/jetde.0902.05

Mazur, E. (1997). *Peer instruction: A user's manual.* Upper Saddle River, NJ: Prentice-Hall.

McDaniel, S., & Caverly, D. C. (2010). Techtalk: The community of inquiry model for an inverted developmental math classroom. *Journal of Developmental Education, 34*(2), 40.

Nga, V. (2019). The project teaching process follows the model of "reversed classroom" for students of the faculty of informatics pedagogy. *Education Magazine, 451*(Kì 1 - 4/2019), 24-27.

Nhat, N. (2021). *A case study of the flipped classroom approach for translation studies in Vietnam.* Doctoral Dissertation, University of Nottingham.

Phuong, L. T., & Anh, B. P. (2017). Teaching according to the flipped classroom model to develop students' self-study ability. *Journal of Educational Administration, 9*(10), 1-8.

Reidsema, C., Kavanagh, L., Hadgraft, R., & Smith, N. (2017). *The flipped classroom practice and practices in higher education.* Singapore: Springer Nature Singapore Pte Ltd.

Roehl, A., Reddy, S. L., & Shannon, G. J. (2013). The flipped classroom: An opportunity to engage millennial students through active learning strategies. *Journal of Family & Consumer Sciences, 105*(2), 44-49. https://doi.org/10.14307/jfcs105.2.12

Saterbak, A., Volz, T., & Wettergreen, M. (2016). Implementing and assessing a flipped classroom model for first-year engineering design. *Advances in Engineering Education, 5*(3), n3.

Schultz, D., Duffield, S., Rasmussen, S. C., & Wageman, J. (2014). Effects of the flipped classroom model on student performance for advanced placement high school chemistry students. *Journal of Chemical Education, 91*(9), 1334-1339. https://doi.org/10.1021/ed400868x

Srinivasan, S., & Tyagi, H. K. (2020). Flipped classroom model -a possibility in the indian higher education system. *Journal of Critical Reviews, 7*(15), 1486-1490.

Taylor, S. S., & Statler, M. (2014). Material matters: Increasing emotional engagement in learning. *Journal of Management Education, 38*(4), 586-607. https://doi.org/10.1177/1052562913489976

Tune, J. D., Sturek, M., & Basile, D. P. (2013). Flipped classroom model improves graduate student performance in cardiovascular, respiratory, and renal physiology. *AJP: Advances in Physiology Education, 37*(4), 316-320. https://doi.org/10.1152/advan.00091.2013

Villalba, M. T., Castilla, G., & Redondo, S. (2018). Factors with influence on the adoption of the flipped classroom model in technical and vocational education. *Journal of Information Technology Education: Research, 17*, 441-469. https://doi.org/10.28945/4121

Vliet, E. A., Winnips, J. C., & Brouwer, N. (2015). Flipped-class pedagogy enhances student metacognition and collaborative-learning strategies in higher education but effect does not persist. *Life Sciences Education, 14*(3), 1-10.

Vu, N. Q., & Thanh, L. T. M. (2017). Applying the flipped classroom model of teaching Digital to develop students' creative thinking capacity. *Science Journal of Ho Chi Minh City University of Education, 14*(1), 16-28.

Walvoord, B. E., & Anderson, V. J. (2011). *Effective grading: A tool for learning and assessment in college.* San Francisco, CA: John Wiley & Sons.

Wang, T. (2017). Overcoming barriers to 'flip": Building teacher's capacity for adoption of flipped classroom in Hong Kong secondary schools. *Research and Practice in Technology Enhanced Learning, 12*(1), 1-11. http://doi.org/10.1186/s41039-017-0047-7

Xinzhuo, H., Yanqing, W., Yan, Z., Wenguo, A., & Lijie, Z. (2021). Factors affecting learning performance in flipped classroom: An empirical study based on RCOI framework. *Education Magazine, 391*, 98-122.

Zainuddin, Z., & Halili, S. H. (2016). Flipped classroom research and trends from different fields of study. *International Review of Research in Open and Distributed Learning, 17*(3), 313-340. https://doi.org/10.19173/irrodl.v17i3.2274