APPLYING FLIPPED-CLASSROOM TEACHING MODEL TO NATURAL SCIENCES TO IMPROVE THE ABILITY OF USING INFORMATION AND COMMUNICATION TECHNOLOGIES FOR PEDAGOGICAL STUDENTS

NGUYEN MAU DUC & NGUYEN THI NGOC

Thai Nguyen University of Education, Thai Nguyen University, Vietnam

ABSTRACT

With the support of information technology (IT), teachers have more opportunities to increase the effectiveness of teaching. Teaching by using the flipped-classroom (FC) method allows students to access lectures and learning resources outside class, thereby enhancing their proactive potential during the regular school hours. In this paper, the author presents the results of his research on the ability to develop IT competence when applying the flipped-classroom method to pedagogical students in teaching Natural Sciences subjects - one of the critical skills that need to be developed by teachers and students of the pedagogical field.

KEYWORDS: *Flipped-Classroom, Skills, Information Technology, Communication & Students*

Received: Jun 09, 2020; **Accepted:** Jun 29, 2020; **Published:** Jul 18, 2020; **Paper Id.:** IJMPERDJUN2020386

INTRODUCTION

Application of information and communication technology (ICT) in teaching in general and chemistry in particular is an indispensable trend in the digital age today. With the challenges of the 4.0 revolution, learners need to be prepared to be able to actively seek, receive, expand knowledge and create. Studies show that an ICT-enabled learning environment contributes to increasing interest, enhancing cognitive capacity, self-study ability, and developing learners' research skills when studying natural sciences [1]. For subjects of natural sciences, the application of ICT plays an important role. This subject has many difficult and abstract concepts, the reaction is too fast or too slow, the progress of processes and phenomena is very difficult or unobservable, some experiments are toxic and dangerous. The above factors make it difficult to teach and study natural science subjects. Therefore, the application of ICT to support the representation of symbols, diagrams, tables, samples, experimental films, etc. is necessary to contribute to increasing the interest, positiveness and engagement of learners in the process of studying this subject [2]. Moreover, through the application of ICT, lecturers / teachers create opportunities for learners to approach and formulate technology application skills, one of the important skill groups of the 21st century [3].

To meet the requirements of ICT application capacity for students in the current context, correctly determining the orientation of ICT application in teaching in general and in Natural Science subjects in particular so as to suit real conditions. After that, it is suggested that measures and well-developed supporting documents to develop the capacity of ICT application for students are extremely necessary.

Within the scope of this article, we present some results of using the flipped classroom model to develop the

capacity of ICT application for students of the natural sciences, and provide experimental results. Initially in applying the flipped classroom model in teaching subjects in the field of Natural Sciences.

RESEARCH CONTENT

Flipped class

Introduction to Flipped Classroom (FC)

Flipped learning a method of teaching to reverse the traditional learning process. This method recommends reversing the teaching and learning steps. That means students listen to lectures while being at home, the practice, application, homework are done in class.

In the traditional classroom, students listen to lectures lecturing the theory in class, teachers do sample exercises, and then assign homework. For reversed classes, students will have to learn through video clips and exploit online materials to formulate knowledge. All the time in class will be spent on homework activities and group discussions under the guidance of the teachers. Instead of lecturing in the classroom, in the flipped classroom, the teacher acts as a facilitator, offering problematic situations to guide students to solve difficult points and systematize the lesson. Perhaps the simplest definition of a FC is reversing of flipping the classroom by converting class activities out of class and vice versa [4] [5]. This activity can be summarized in the table below.

Table 1: Conversion activity between FC and traditional class

Type	In the class	Outside the classroom
Traditional classroom	Lesson / lecture	Exercises and practice
Flipped classrooms	Exercises and practice	Video lecture

From traditional teaching methods, teachers are the center of the classroom. The change in the methodology of flipped learning is that learners are centered, the content is mainly on computers, through videos or teaching materials provided by teachers, not lessons. Lectures are the combination of teacher-training methods and are combined with computer-based learning with the aim of increasing practice and proactively approaching knowledge. The role of the teacher will shift from the instructor to the facilitator role.

Thus, the nature of the reversal class is to increase the time for teachers and students' interaction, thereby it increases the students' activeness when participating in problem solving. This is done by reversing (flipping) the time and space in which educational actions take place, creating tremendous time gaps for interaction. Therefore, teachers need to be aware of the importance of GV-SV interaction, as well as the principle to move downtime out of the classroom, to devote real time to doing interaction.

Process of Implementing Flipped Classroom

The nature of flipped learning is that it aims to activate learners' learning, focusing on the interaction between students and the learning environment in order to update and improve knowledge from inherent knowledge of students to knowledge to be acquired. Teachers must create an environment to promote the creation of knowledge for learners by combining with the brainstorm method [6]. Flipped class is a "traditional" educational change. With FC, students have direct access to knowledge and teachers act as a mentor and mentor. With this model, students must prepare questions to discuss with their teachers. During discussion, teachers can focus on the application and more thorough handling of learning materials. In some ways the

elements are different from the traditional classroom but in reverse view is the strength of FC.

We have applied the training approach "in technology" through the form of FC teaching [7]. When attending the course, students will experience the form and characteristics of online learning. In the position of learners, students know how to learn, how to exchange and share information in class online. Through modeling teachers, students learn how to manage a classroom online, notes and experiences when making online assignments for learners. In particular, it is this learning that has developed the skills to use Internet of students naturally and effectively.

According to the authors (Bergmann and Sams, 2012), (Brame, 2013), we formulate the process of specific FC model as follows:

Figure 1: Process of performing flipped classroom

By applying the above FC method, teachers will have more time to deploy other activities such as answering questions and difficulties for forming and training certain ICT skills for students. The practice of technical manipulations at home through instructional documents and videos helps teachers and students save time in class instruction. At the same time, students can choose the schedule and study time suitable to their own time and ability conditions.

Based on the facilities, qualifications and study habits of students as well as the requirements of the module, we determine the specific combination. In the course, online and offline learning are flexibly combined to support students to achieve the goals set out in the course. If students self-study to train in terms of technology techniques at home, in class, in addition to consolidating technological skills, students focus on the effective use of ICT-based teaching products that students designed through reports, discussions, or classroom experiences.

Capacity of Information and Communication Technology Application in Teaching Science Subjects for Pedagogical Students of Natural Sciences

Concept

The ability to apply ICT in teaching is defined as the ability to effectively use technology tools and resources to effectively communicate, create, disseminate, store and manage information in teaching activities [8]. The information herein is

interpreted as data related to the teaching process (text, images, movies, audio, etc.) processed, stored or transferred via computer or internet. Technological tools and resources include technical equipment (computers, projectors, internet, etc.), computer software and online applications.

Information Technology and Student Competency Framework

To design a toolkit to evaluate students' ability to apply ICT, it is necessary to base on the concepts, manifestations of ICT application capacity, standards, criteria and levels of expressing ICT application capacity of students in studying natural sciences subjects (Chemistry, physics, mathematics) at Pedagogical University. On that basis, we have studied and determined the expression of criteria and levels of evaluation of pedagogical ICT application competence of pedagogical students through flipped classroom teaching and presented in the following table [8].

Table 2: ICT application capacity framework for natural Science students

Criteria	Assess the level of capacity development in ICT application			
	Level 1 (1 point)	Level 2 (2points)	Level 3 (3points)	Level 4 (4points)
1. Updating and analyzing trends and policies of ICT application in teaching in the world and in the country.				
2. Proposing plans to apply ICT in the teaching process in accordance with objective and subjective conditions.				
3. Using ordinary technical means such as computers, projectors, players, etc. in teaching Natural Sciences subjects.				
4. Using the internet to search, exploit and manage information for teaching natural science.				
5. Using software to design and edit teaching materials in Natural Sciences subjects such as documents, slideshows, pictures, photos, movies, simulations, etc.				
6. Combining the application of ICTs with active teaching methods and specific teaching methods of Natural Sciences subjects according to the orientation of developing learners' energy.				
7. Application of ICTs to use a variety of assessment forms, in order to provide feedback on teaching for teachers and students.				
8. Using ICT tools to manage time, organize classes.				
9. Using ICT tools to communicate, monitor, manage and support students outside the classroom.				
10. Using the internet and advanced search tools to update information related to their professional fields; Reference, share resources, work collaboratively with others.				

Experimental Results on Pedagogical Development of ICT Application Capacity in Teaching Natural Sciences to High School Students through a Flipped Classroom Model

We conduct pedagogical experiments to evaluate the feasibility and effectiveness of measures to develop the capacity of ICT application in teaching pedagogical students in natural science subjects (chemistry, physics, mathematics) based on analysis of results [9].

The area of pedagogical experiment is at department of chemistry, physics and mathematics of University of education- Thai Nguyen University. Currently, due to Covid -19 epidemic, all students are taught online through online teaching software uncluding Zoom, Trans, Microsoft Teams and the support of some teaching websites and other auxiliary

software such as google classroom, etc.

The subjects of pedagogical experiment were selected as 3rd or 4th year students (students who belong to “K51, K52” courses) of the centralized pedagogical system, with a number of experimental students including 38 students in the department of chemistry, 32 students in the department of physics, 68 students of mathematics department.

Statistics of average scores (AS) of ICT application capacity, standard deviation (SD), p value in T-test and impact factor (IF) based on previous test results and exercises The post-impact situations for the experimental classes (EC) and confront classes (CC) are presented in Table 3.

Table 3: Typical parameters of ICT application competency of students of experimental classes and general confront classes before impact (BI) and after impact (AI)

University of education- Class	BI		AI		p	Impact factor
	TB	SD	TB	SD		
Class 1_ EC	1,88	0,35	3,21	0,26	1,82.10-4	1,28
Class 1_ CC	1,82	0,25	2,86	0,28		
Class 2_ EC	1,79	0,25	3,24	0,28	2,18.10-4	1,18
Class 2_ CC	1,81	0,25	2,86	0,28		
Class 3_ EC	1,85	0,26	3,21	0,24	9,68.10-6	1,26
Class 3_ CC	1,79	0,24	2,89	0,25

Figure 2: Capacity of applying ICT in teaching of TN-participating groups participating in experiments

From the results of statistical analysis of the capacity of ICT application in teachers' teaching at the time of after

impact for similar groups and comparison of the points of application capacity of ICT at two points of before impact and after impact to a single group shows that ICT application capacity of students participating in experiments with the flipped classroom model in the module of Application of ICT in teaching natural sciences is better than those of students studying in the traditional method [10]. Specifically:

With equivalent groups

The average value of the experimental group is higher than the control group, and the probability of random occurrence is much less than 5%, so it is possible to conclude that the capacity of applying ICT in teaching natural resources of the experimental group is better than that of the control group and This difference is due to capacity development according to the proposed procedure and measures.

Standard deviation of experimental groups is lower than control groups, proving that the quality of experimental groups is more uniform than control groups.

Influence level values are all greater than 0.8, compared to the Cohen table, it is possible to conclude the effect of measures to develop ICT application capacity through the application of the results-reversed classroom model at very big. With this level of influence, the proposed method can be applied in practical teaching in high schools.

Considering the competency grades of piloting and controlling classes at the two points of the assessment and the exercise, it can be seen that the capacity of students in both classes develops in Natural Sciences subjects. However, at the time of vocational training, most of the competency scores of each criteria of the experimental classes are higher than the control classes. Especially, there are clear differences in criteria 2 (propose suitable ICT application solutions), 3 (using technical means), 6 (coordination of active teaching methods) and 8 (application ICT to organize and manage class) between experimental class class and confront classes. This can be explained by the positive effects of ICT development capacity development, in the course of teaching modules, students are required to learn and practice the software at Through instructional materials through teachers' online teaching website and online teaching software, students have plenty of time in the classroom to discuss how to use ICT tools in teaching. Natural Sciences subjects and teaching practice with those tools. There is not much difference in the average TB score in criterion 1 (updating ICT application policies and trends) and criterion 5 (using software to design teaching materials). This is because students in both general and experimental classes have access to these important content in the basic informatics modules as well as ICT applications in specialized teaching in the faculties.

Average score of ICT application capability is much higher than “before impact” when comparing to “after impact”, meaning that the capacity of ICT application in teaching of students is significantly improved.

STD, over 90% of students reach the level of ICT application in teaching from level 3, of which level 3 is over 70%, the proficiency level reaches 11.67% - 23.81%.

According to the author's assessment and through the feedback of students with the flipped classroom organization model with the help of the online learning system, there have been positive signs, that is, students are actively active in studying because the students are regularly checked and evaluated and the evaluation results affect the students' rights, so the idea that by the time of the exam they will study no longer exist.

CONCLUSIONS

Through pedagogical experiments, we found that flipped classroom is an effective teaching model that can be applied in teaching natural sciences to develop the capacity of ICT application for pedagogical students at universities. The experimental results we analyzed show that developing the capacity of applying ICT in teaching Science subjects is feasible and effective for students at Pedagogical University, helping students to be able to self-study, promote creativity with favorite subjects, understand the world around them scientifically, and this is one of the teaching methods that can be applied to design and organize integrated lessons for building online teaching programs at universities, especially during the Covid 19 epidemic season, a period when the epidemic situation is complicated worldwide and in danger of lasting.

At present, although E-learning is strongly developing, in the context of Vietnam's education, there are still some shortcomings, the reversal teaching model has proved to be feasible for application in training in general, fostering information technology skills in particular for pedagogical students. This can be based on the psychological characteristics, cognitive level of learners, and the peculiarities of the subject, the FC model can still apply to all or part of the subject. In order to develop the capacity of ICT application for students to be effectively implemented in a teaching environment using ICT, in addition to ensuring physical factors, teachers need to regularly develop their own ICT application capacity themselves.

WORK ASSIGNMENT

Dr Nguyen Mau Duc was responsible for organizing experimental teaching to verify the results of flipped classroom research in order to develop teaching capacity for students of natural sciences. Dr. Nguyen Thi Ngoc did the research theory of flipped classroom model, IT application capacity for pedagogical students. The corresponding authors' emails are: ducnm@tue.edu.vn; ngocnt.psy@tue.edu.vn

ACKNOWLEDGEMENTS

This research is funded by the Vietnam Ministry of Education and Training with the code B2020-TNA-07

CONFLICT OF INTEREST

There is no conflict of interest in the paper

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