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Design and Application of Teaching Model of Flipped Classroom on Information Technology Course

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Abstract

With the rapid development of information technology, modern information technology is gradually changing people's life, study and work. People have clearly recognized that information collection, transmission, processing and application ability has become a most basic ability and the marker of the cultural level. Information technology, as a modern new discipline, compared with other subjects, it has its remarkable characteristics that in the process of learning it pays more attention to cultivate the students' ability of hands, brains and initiative exploration. As educators work in the line of the disciplines of information technology, seriously exploring the subject of teaching mode so as to do well the teaching of information technology course and improve the teaching effect is their responsibility. Nowadays, many students lack learning interest in information technology course. Investigating its causes, we find problems occur in the teachers' teaching methods. Most domestic schools generally use cramming teaching methods, blindly instill the knowledge in students no matter they have digested or attracted. For the knowledge teachers taught, they just heard and they just have the impression on the knowledge learned, ignoring the students' creative, hands-on, and thinking ability. This kind of traditional information technology course cannot well mobilize students' interest in learning information technology course. In contrast with the cramming method of teaching is the heuristic teaching method, whose important feature is considering the importance of the application of knowledge. Under the guidance of the teaching mode, flipped classroom concept in the heuristic teaching mode enters into people's vision. The flipped classroom refers to change the traditional teaching mode of teachers explaining the new knowledge for students in the classroom, and students consolidate new knowledge through their own independent homework to the teaching mode of students learning new knowledge independently after class and doing exercises to consolidate the digest new knowledge in the classroom with teachers. The author, after reading the flipped classroom theories and teaching research, combined with the characteristics of information technology disciplines, constructs information technology teaching model based on flipped classroom concept. In the practice process, test the effects of applying flipped classroom in information technology teaching, and gradually modifies and perfects it. Under the background of information culture in our country, explore the information technology teaching model based on flipped classroom concept characterized by the local culture.

Keywords*: Flipped Classroom; Information Technology Course; teaching mode*

1. Introduction

Since the introduction of flipped classroom to our country, the instructional practice has been carried out in many basic education subjects, while such practice is relatively less in information technology subjects. On the one hand, the information technology course in the basic education is an important starting point to enhance the informatization level of basic education. It can enhance students' information literacy, and plays the role of initiative innovation and demonstration of the Teaching Model. On the other hand,

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many problems exist in the information technology course in the basic education, which two outstanding problems are: The Teaching Model is too traditional; students are hardly interested in the information technology course, and digital resources supporting the teaching materials have the low utilization rate due to the restriction from classroom duration. Therefore, the information technology course in middle school introduces flipped classroom, for the purpose of improving the instructional quality and realizing its value in informatization of basic education.

1.1. Research Background

1.1.1. New Requirements of the New Curriculum Reform to the Classroom Teaching

"National medium and long term education reform and development plan (2010-2020)" puts forward: initiate the heuristic, the discussion type, the inquiry type, the participation type teaching, teachers guide and help the student to learn to study. Stimulate students' curiosity and thirst for knowledge, protect the student's self-esteem, cultivate students' interest hobbies and personality development, creates good learning atmosphere of independent thinking, freedom to explore, innovation for students. It also puts forward strengthening the application of information technology. Strengthen the level of teachers' application of information technology, constantly update the concept of teaching and learning, constantly improve the teaching methods, and improve the quality of teaching. Encourage students to make full use of information technology tools to take active learning, autonomous learning, and enhance the ability to use information technology to analyze and solve problems. "Basic education curriculum reform outline (Trial)" also makes it clear that it necessary to strengthen the reform of students' learning style, change the current situation of rote learning, receiving learning, and mechanical training. Moreover, advocate that students take the initiative to participate in classroom activities, willing to discover, and diligent hands-on brain, cultivate students' ability of information collecting, information processing, and new knowledge acquisition, and the ability of analyzing and solving problems as well as communicating and cooperating with others; cultivate students' independence, autonomy, creativity, guide the students to solve the problem step by step, cultivate questioning attitude, and then carry on the investigation and research, so as to promote students obtain new knowledge in practice.

1.1.2. Current Situation and Challenge of Information Technology Course

With the accelerated development of information technology, possessing the ability of information technology has become the most basic requirement for talents in today's society. Primary and secondary school information technology course is a course combining theory with practice. How to carry out effective teaching to improve students' thinking ability and the ability of solving practical problems has become a difficult problem for the teacher. At the same time, information technology subject has its own characteristics, interest, and it has close relation with real life. In consequence, it is deeply loved by learners. Information technology disciplines has great significance in the cultivation of learners' innovation ability, cooperation ability, and communication collaboration ability. As a result, many educational researchers have begun to focus on the reform of the teaching structure and teaching model of information technology curriculum. Along with the gradual popularization of information technology education, learners' information technology ability training is importantly listed in the new curriculum of basic education, and primary schools in various regions also correspondingly open information technology course. However, because of the great difference in the various regions of the political, economic and cultural development level, information technology development level of every area also exists great difference, not every region has attached great importance to the teaching of information technology curriculum. As a result,

students from different areas have different information technology ability so that it brings difficulty for information technology teacher's teaching.

The most prominent embodiment is that in the usual study, information technology teachers and students do not attach importance to information technology course. Instead, they always do several sets of questions before the exam and used to thinking that everything will be fine. In information technology class, students' learning efficiency is not high. Teachers just blindly adopt cramming method to instill the theoretical knowledge in students, while overlook an important point, student's hands-on ability. In the whole process of classroom teaching, students cannot listen to teachers carefully, resulting in disorder in the classroom teaching. In the whole learning process, students have no clear understanding of cooperation and exploration problems. They tend to begin learning activities without preparation in advance, so the result is often that they just say what is in their mind. Without filtering the original possessed knowledge, students directly speak out what they want, which is the activity detached of subject learning. The teaching activities organized by teachers are always difficult to meet the needs of all the students. Some students think that the content explained by teachers is too simple, hoping that the teachers can enhance the degree of difficulty; however, the rest believes that teacher's teaching progress is too fast, knowledge taught in the classroom is too much that students find it difficult to keep up with the progress. Because the teacher's teaching is difficult to meet the personalized learning needs of each student, however, the students' dissatisfaction has a direct impact on the enthusiasm of teachers' teaching, such kind of chain reaction ultimately impacts the implementation of the teaching object.

1.2. Research Significance

The first one is theoretical significance. At present, the researches on the flipped classroom have only done two things. One is that it made a detailed introduction to foreign flipped classroom, and the second is that it made their evaluation on foreign flip classroom. While the practice in line with the national condition of our country is rarely. Flipped classroom wanting to get further development in our country, the first thing to do is to possess the teaching mode of providing the implementation of a flipped classroom, reform the original classroom teaching, and expect to achieve good teaching effect. This paper, based on the research on the flipped classroom model, defines the concept of the flipped classroom, carries on the analysis to the implementation of information technology curriculum, and provides the flipped classroom teaching design pattern that has practical guidance. In view of this, the study can enrich and perfect flip classroom teaching mode, teaching methods and teaching strategies, and improve the quality of education in our country.

The second is practical significance. Through the further research on the original flipped classroom, it has been found that a new teaching mode of information technology teaching improves the students' information literacy, promotes the reform of classroom teaching, and improves the quality of teaching. Therefore, based on the above theoretical significance and practical significance, this research puts forward the application research of information technology teaching model based on the flipped classroom concept, and hopes that the new teaching model can optimize the teaching of information technology.

2. Literature Review

Origin of flipped classroom in the United States, it proposed only few short years. But education researchers and teachers pay close attention to it around the world. It has become a hot topic in recent years.

Flip the classroom first appeared in Harvard University, 1991, the school's professor Eric Mazur in his physics curriculum began to use the "peer teaching method", the specific operation requirements of the method are: students learn course content outside

the classroom. In the classroom, students ask questions, thinking, discussion, and answer as the main theme of teaching activities [1]. Although Eric Mazur did not explicitly put forward the concept of "flipped classroom", but it is not difficult to see that the teaching method has agreement with the flipped classroom. In 1996, Miami University Teachers Maureen J. Lage and Glenn J. Platt in their course of "principles of microeconomics" first formed the rudiment of the flipped classroom [2]. United States held the 11th International University Teaching and academic seminar in the 2000, J. Wesley Baker submitted the “Flip: Using Web Course Management Tools to Become the Guide by the Side”, it caused the strong interest of participants. This article put forward "flipped classroom model", which is a more mature model to the development of the flipped classroom at this stage. In this study, it also clearly describes the essence of the flipped classroom [3, 4]. The vigorous development of the flipped classroom began in 2007, Woodland Park High School is located in the Colorado Rocky Mountain, there are two chemists Jon Bergmann and Aaron SAMs began using this model [5]. In 2011, in California, Salman Khan by virtue of the video reconstruction of education "exquisite speech shocked conference of scholars whose attend the TED at the time, which trigger the upsurge of research flipped classroom theory and experiment flipped classroom teaching mode in the world of education.

Analysis from the collected data, the scholars in our country currently the focus of the flipped classroom is mainly the introduction of foreign research results reporting and the macroscopic theory model construction. In China the earliest start the flipped classroom concept application in teaching practice is located in the Fifth Middle School of Zhuhai, Guangzhou and Chongqing Jukui secondary school, it achieved a good experimental effect. In addition to this, there are some teachers in our country have begun to actively use flipped classroom teaching mode to innovate their own classroom, such as, some teachers use the Moodle platform to carry on the turning teaching experiment in English classroom, Career Technical College teachers use flipped classroom thinking to adjust their teaching.

3. Design of Teaching Model of Flipped Classroom on Information Technology Course

On the basis of the related domestic and overseas Teaching Model, in accordance with the Constructivism, Mastery Learning Theory, Humanistic Theory, and the Theory on Zone of Proximal Development, we design the model from the perspective of teachers and students, and list the specific teaching links in the model diagram, which is convenient for teaching workers to refer to such model. With the continuous improvement of the instructional practice, this flipped classroom Teaching Model on information technology course in middle school has been designed (show in Figure 1).

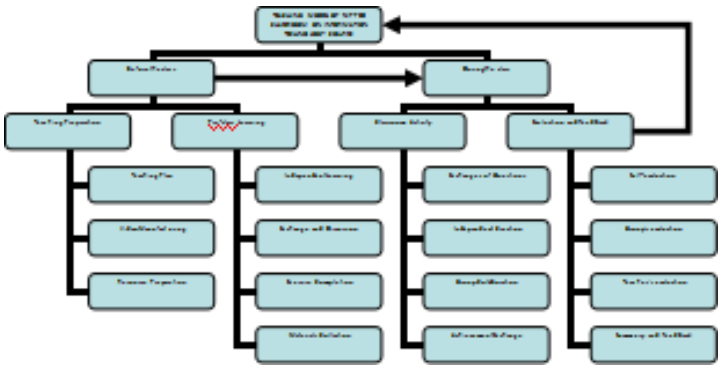

Figure 1. Flipped Classroom Teaching Model on Information Technology Course in Middle School

The Teaching Model is designed to include two links - "Before the Class" and "During the Class". Expressed with a circle in the clockwise direction, this model has the cyclic process. "Before the Class" includes two stages - "Teaching Preparation" and "Pre-class Learning". "During the Class" includes two stages - "Classroom Activity" and "Evaluation and Feedback". Flipped classroom is a bilateral interaction process composed of teachers' teaching and students' learning, therefore this model starts from the perspective of teachers and students; with its "circle" framework. This model reflects that teaching links influence with each other in the cyclic process; teachers can easily learn from the model due to its clear teaching process and strong sequence.

3. Analysis of the Teaching Process

3.1. Teaching Preparation

Teaching Plan: Before implementing the flipped classroom Teaching Model, the teacher should have a detailed teaching plan of the whole lesson, including such various plans as teaching objectives, teaching content, teaching video, homework, exercise, work theme, and evaluation scale, as well as a series of plan preparations - the exchange platform, exchange time, and student grouping.

Video Manufacturing: The careful designed and recorded teaching video, which can effectively attract students' attention. It is the cornerstone of implementing the flipped classroom teaching. The video of each lesson can be divided into several sections according to the teaching content, and in information technology courses of middle school. The video is generally divided into 5 sections with no longer than 10 minutes for each, which can effectively reduce the cognitive load of learners, ensure that they complete the related learning within a relatively short period, and effectively improve the utilization rate of learning resources and learning efficiency of learners [6]. The video which is manufactured by the teacher should guide students to actively participate in the learning from teaching video. Some excellent open resources are available on the network, but these ready-made teaching resources are often inconsistent with the actual teaching objectives, so that teachers should create the video on their own.

Resource Preparation: Before the class, the teacher completes the resource integration to build the learning resource package [7]. Learning resource package: is generally the compressed file package. As the main line of such file package, the courseware can be produced with such tools as PPT and web page. When the courseware is played, students can learn based on the tips provided by the courseware. The courseware should have the navigation, according to which students can complete their self-paced learning. Such navigation consists of learning objective, list of learning tasks, teaching video, operation exercise, question submission, and challenging exercises. Teaching video can be divided into multiple videos according to the teaching content; students can view the video through clicking the corresponding link.

3.2. Pre-class Learning

Independent Learning: It is the important link of students' pre-class learning. Independent learning starts from the acquisition of knowledge. Students should first download learning resource package through the network platform, and then begin their self-paced learning. Students can learn under the guidance of the courseware's navigation. In order to improve the learning efficiency, students can forward and backward the teaching video according to learning objectives and their background of knowledge and skills, and can also pause the video for noting the question.

Exchange and Discussion: It includes instant exchange and group exchange. In the instant exchange, students can exchange and discuss with each other through such functions of QQ Group as group voice, group video, screening room, discussion group,

and post bar. Group members can share the learning gains, explore and solve the problems encountered in the process of learning the teaching video and pre-class exercise. For those problems that cannot be solved by group members, they can contact with the teacher, and the teacher will provide individual counseling and answer the related questions. During the group exchange (the duration is about one hour), teachers and students answer the questions in the real-time way through QQ Group. In addition, the teacher can check students' learning situation by asking questions and then exchange and discuss some questions raised by students during their independent learning.

Exercise Completion: When setting up the corresponding exercises according to the teaching content in the stage of resource preparation, the teacher should take full consideration of students' cognitive structure and reasonably design the exercises with appropriate difficulty and quantity, so that the exercises will be challenging for students, and students' interest in learning will be aroused. Through learning the teaching video, students complete the corresponding exercises, and send the completed exercises to the teacher's e-mail. The teacher will give the evaluation on exercise completion, and provide individual counseling according to the evaluation results.

Materias Collection: The group determines the work theme and job division of each group member through exchange and discussion, according to the teaching objectives and tasks which are assigned by the teacher, and then each student collects the materials, according to the group theme and his/her own task, through the resource library provided by the teacher and the network. Finally, the group leader completes the resource integration and shares such resources with each group member in the classroom.

3.3. Classroom Activity

Exchanges of Questions: The most core value of flipped classroom is reflected in the face-to-face exchange between teachers and students [7]. Teachers and students should determine the questions to be explored in the classroom. The teacher can put forward some questions according to the important and difficult teaching contents, and students can also put forward the questions according to their own situation of pre-class learning. In the Classroom Activity, teachers and students will exchange and solve these questions. Students can solve the questions through the group cooperative inquiry; if students cannot solve the question, the teacher will make the detailed explanation and demonstration of these questions.

Independent Creation: Students complete the creation of individual works as per the teacher's requirements. In the flipped classroom, the teacher should pay attention to cultivating students' ability to independently finish tasks and solve problems. Only when students think about and solve problems independently, can the knowledge internalization be promoted, and thus can their own knowledge system be built in the systematic way. The teacher should pay attention to the link, leaving the time for students to independently create the work and solve the problem.

Group Collaboration: In the flipped classroom, we should cultivate the cooperation consciousness of students, and divide them into different groups, with 3-5 students for each group. In each group, a group leader is elected to organize the inquiry activities of the group. When the student independently creates his/her own work in the classroom, if he/she cannot solve the question, he/she can exchange and discuss such question in the group. Group members accomplish the learning objectives through collaboration. The teacher needs to capture the dynamics of each group's inquiry and guide them in a timely manner.

Achievement Exchange: After the independent and collaborative inquiry, students display their works in the classroom. During the achievement display, the student can talk about the intention, advantages and shortcomings of his/her designed work, and then other

group members can evaluate such work. The teacher can also organize the "small contest", on which each group can exchange, comment, and share and learning gains.

3.4. Evaluation and Feedback

The evaluation of flipped classroom should be multi-dimensional and multi-mode. The evaluation should pay attention to students' ability to solve practical problems [8]. The evaluation content includes process evaluation and summative evaluation. Process evaluation includes students' exercise completion, the situation of putting forward the problem, independent inquiry in the classroom, and the enthusiasm for group collaborative inquiry. Summative evaluation mainly refers to achievement display. Evaluation methods consist of self-evaluation, group's evaluation, and teacher's evaluation. Finally, the teacher collects statistics of evaluation results, and gives the feedback on teaching through evaluation results, so as to strengthen and remedy students' shortcomings, and improve such shortcomings of the future courses.

4. Application of Flipped Classroom Teaching Model on Information Technology

4.1. Experimental Process

The duration of this instructional experiment is one semester. The experimental objects are the students from two classes at one middle school in Jiangsu province - Class (1) and (2) of Grade one. 53 students of Class (1) are the experimental objects, and 56 students from Class (2) are the control objects. Students in the experimental class are taught with the Teaching Model of flipped classroom, and students in the control class are taught with the traditional model. These two classes have the same teacher, and the basically same teaching content and teaching period.

Experiment hypothesis: Through the experiment, students' information literacy can be enhanced and independent learning capacity can be upgraded.

4.2. Analysis and Discussion of Experimental Results

4.2.1. Comparison of Information Literacy between Pre-experiment and After-experiment

Before the experiment, the pre-test is implemented on students from the experimental class and control class, to analyze if there's significant difference in the pre-test scores of students from two classes. It can be seen from Table 1 that there is no significant difference in the pre-test scores between the experimental class and the control class. Therefore, before implementing the Teaching Model, there is no significant difference in pre-test scores of students between the experimental class and the control class, and students' information literacy is basically the same.

Table 1. Difference Analysis of Pre-Test Information Literacy Scores of Students from the Experimental Class and Control Class

Class	n	Mean Value	Standard Deviation	t
Pre-test Score				
Experimental Class	53	75.68	9.158	0.133
Control Class	56	75.45	9.141	

After completing the experimental process, we carry out the after-test on students from the experimental class and the control class to analyze if there is a significant difference in the after-test scores of students between the two classes. It can be seen from Table 2 that the average scores of the experimental class and the control class are 81.83 and 76.14 respectively. A significant level of difference ($p<0.001$) has been found between the difference in their scores. As a result, after the flipped classroom has been implemented for nearly one semester, there are significant differences in students' scores between the experimental class and the control class, which shows that this Teaching Model can enhance information literacy of students.

Table 2. Difference Analysis of after-Test Information Literacy Scores of Students from the Experimental Class and Control Class

Class	n	Mean Value	Standard Deviation	t
After-test Score Experimental Class	53	81.83	7.226	3.697***
Control Class	56	76.14	8.719	

Note: ** indicates $p<0.01$, ***indicates $p<0.001$, the same below

4.2.2. Comparison of Independent Learning Capacity between Pre-experiment and After-experiment

Before the experiment, the pre-test is implemented on students' independent learning capacity from the experimental class and control class, to analyze if there's significant difference in the independent learning capacity of students from two classes. It can be seen from Table 3 that there is no significant difference in the pre-test scores between the experimental class and the control class. Therefore, before implementing the Teaching Model, there's no significant difference in independent learning capacity of students between the experimental class and the control class, and students' independent learning capacity is basically the same.

Table 3. Statistical Table of Pre-Test on Independent Learning Capacity of Students from the Experimental Class and Control Class

Class	n	Mean Value	Standard Deviation	t
Pre-test Score				
Experimental Class	53	68.70	9.943	-0.281
Control Class	56	69.23	9.894	

Through testing the independent sample 't' of students' after-test scores from these two classes, the result is shown in Table 4: a significant level of difference ($p<0.01$) has been found between the difference in their scores, significant ($p<0.01$). After the flipped classroom has been implemented for nearly one semester, there's the significant difference in the information literacy of students from the experimental class and control class, which shows that this Teaching Model can upgrade students' independent learning capacity.

Table 4. Statistical Table of Pre-Test on Independent Learning Capacity of Students from the Experimental Class and Control Class

Class	n	Mean Value	Standard Deviation	t
Pre-test Score				
Experimental Class	53	75.91	9.195	2.87**
Control Class	56	70.19	9.413	

5. Conclusion

This research constructs the flipped classroom Teaching Model on information technology course in middle school, and the teaching experiment results show that this Teaching Model is proved effective in enhancing information literacy and upgrading independent learning capacity of middle school students. The information technology discipline promotes the learning of other disciplines. The main purpose of information technology discipline is to cultivate more citizens who have information literacy for the modernization construction of our country. In information technology teaching process, it can effectively change the traditional teaching mode of the flipped classroom teaching ideas and learning styles of students, inspire students' learning interest, improve teaching quality, and optimize the information technology teaching. The information technology teaching mode can improve students' interest in learning information technology through the autonomous learning or cooperative research among learners. More importantly, cultivate the learning enthusiasm and creativity and initiative in their learning process. Through the practice, it is proved that the application of the flipped classroom teaching mode is effective in information technology teaching, which can optimize the traditional teaching mode.

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