Flipped Classroom Teaching System Design under the Background of Subject Reform Based on Information Technology

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Abstract. With the rapid development of modern information technology, some traditional teaching models in colleges and universities will not be able to adapt to the pace of change. The new teaching model flipped classroom not only meets the requirements of our country's new curriculum reform, but also allows students to reduce the burden of learning after class, and achieve the best of both worlds. The purpose of this article is to study the design of the flipped classroom teaching system under the background of subject reform based on information technology. This article adopts literature research method, survey research method and action research method to carry out research. This article summarizes the flipped classroom teaching mode and practical cases through a literature review of relevant domestic and foreign literature. This article proposes how schools and teachers should respond to the development of information technology and the development trend of "flipped classroom" under the current situation, and provide certain guiding suggestions for future classroom teaching reforms. This article selects two classes of teachers and students in a university in this city as the research objects, investigates the current teaching status of the curriculum, summarizes and analyzes the characteristics and problems, and draws on the results of existing practical research to initially build a flipped classroom suitable for this teaching practice Model, and based on this model, select the content, carry out the teaching design and practical experiment of the flipped classroom, and finally this article carefully summarizes and reflects on the practice. The survey results show that 85.45% of students find it helpful to increase the communication activities between teachers and students and between students in the classroom, and students can gain from the exchange and cooperation.

Keywords: Information Technology, Flipped Classroom, Teaching Mode, Teaching Goal
1. Introduction
From the perspective of the development speed of the information age, the wave of technological revolution also promotes the continuous erosion of the education field by informatization [1-2], and education informatization has become a new trend in education development. Based on the advantages of informatization and big data technology, the new digital learning is working hard to promote the informatization of education [3-4]. The development of flipped classrooms coincides with such an environment and opportunity. It is a manifestation of information technology serving teaching. It is also an innovation of the traditional classroom teaching mode [5-6]. It is organically integrated with "digital information technology", breaking the time limit, passing through the tunnel of time and space, and allowing high-quality educational resources to better meet the individual needs of learners [7-8].

In the research on the design of flipped classroom teaching system under the background of subject reform based on information technology, many scholars have conducted research on this and achieved good results. For example, Yang Y suggested that schools and teachers should pay attention to the gradual progress when developing flipped classroom teaching mode. The monthly teaching videos should not be too many to keep students' interest in learning. In this process, teachers should continuously hone their own teaching art [9]. Abeysekera L selected two experimental classes and conducted experiments on flipped classroom teaching mode in several subjects. In the stage of learning new knowledge before class, promptly produce teaching videos for students to learn and guides to guide students to learn, and transmit them to the school’s "Campus Cloud" platform, where students can use their computers on the "Campus Cloud" platform at home. Download the content of the pre-class study on your own [10].

This article mainly refers to related books and uses network information retrieval methods to collect and learn the latest research results and cases related to flipped classrooms at home and abroad, learn about them, understand and be familiar with the specific methods and procedures of flipped classroom implementation, and analyze, study the practical application of flipped classroom teaching in other disciplines and other schools, draw on and learn from the successful practices and experiences, and carefully analyze the reasons for failure. It also fully explained the relevant policy content of the development and implementation of information technology courses in my country, and proposed relevant teaching practical experience and methods,

2. Design of Flipped Classroom Teaching System Under the Background of Subject Reform Based on Information Technology

2.1 Concept of Information Technology Curriculum Reform
The new curriculum reform of information technology in colleges and universities upholds the purpose of improving students' information literacy, with the main purpose of improving students' information processing ability, enhancing information awareness, and internalizing information ethics, that is, paying attention to the present and looking to the future, and not only cultivates the information age. The practical ability to create a good information environment, and to create a good atmosphere for the cultivation of lifelong learning, innovative practice, communication and cooperation, etc., and truly pay attention to the physical and mental health and growth of students are also the biggest innovations of this curriculum reform.

(1) Information technology elective modules in universities
The main learning purpose of the module algorithm and program design selected by the school is to further feel the charm of the algorithm on the basis of the original understanding of the algorithm thinking of the students, and understand the position and function of the algorithm in the process of using the computer to write programs to solve problems. And can be combined with real life, allowing students to design algorithms for simple problems, use programming language to write programs, and solve problems, thereby improving students' ability to use computers to solve problems.
(2) Flipped classroom teaching mode
As a new type of teaching mode, the biggest feature that distinguishes it from traditional teaching is that the classroom teaching process is reversed. The content taught in the traditional classroom is placed before the class, and the traditional classroom homework, exercises and other activities or the content is put in the classroom, that is, the traditional teaching process of "teaching + after-class practice" becomes a flipped classroom teaching mode of "self-study before class + classroom practice".

2.2 Flipped Classroom Teaching Model Design

(1) The basis for constructing Flipped classroom teaching model
The construction of the flipped classroom teaching mode will provide a convenient process structure for the implementation of teaching practice. When designing the teaching mode, we must grasp the following design principles:

1) To facilitate the construction and internalization of student knowledge
Flipped classroom puts traditional knowledge transfer before the class, and increases the time for teacher-student communication and interaction. The teacher is the coordinator and instructor of learning activities. It is necessary to mobilize students, stimulate their vitality, and make students better complete the construction and internalization of knowledge.

2) To facilitate the realization of hierarchical teaching
Traditional classroom teaching activities can actually only take care of one-third of the students, and it is difficult to take care of the students at both ends. In flipped classroom teaching, teachers can provide students with a variety of learning resources before class. Students can arrange personalized learning independently without worrying about affecting other students. The learning progress is completely under their control, and there is no need to worry about it. Omission, so as to truly realize personalized learning and hierarchical teaching.

(2) Issues to be considered when designing a flipped classroom teaching model
There are several aspects that should be considered when flipping the classroom teaching model: first, pay attention to the role of flipped classroom teaching design, carefully prepare, develop and produce learning videos and other resources; second, pay attention to activities such as teacher-student learning, communication, and interaction in the classroom. Reasonable arrangement and clever design; third, use after-class feedback and reflection to discover problems in time, and modify the flipped classroom teaching design.

2.3 Each Link and Implementation Process in the Flipped Classroom Teaching Model

(1) Teaching preparation

1) Teaching plan
Including teaching objectives, content, homework, exercises, tests, etc. In addition, some exchanges and interactive activities also need to be planned and prepared.

2) Create an information education environment
Choose online learning and management platforms, and create online discussion groups. For the platform's functions and usage methods, such as resource download method, test completion method, online communication and discussion, etc., students should be proficient. Ensure that the discussion
group has a manager with strong organizational skills, and can arrange multiple people and divide the labor. For example, the disciplinary team leader is responsible for managing the discipline of communication and discussion within the group, and the learning committee is responsible for recording communication and discussion issues.

(2) Study before class
Autonomous learning: Autonomous learning is an important part of the implementation process of flipped classroom. Under the guidance of the "Learning Task List", students independently select learning resources from the "Learning Resource Pack", and adjust their learning progress and speed according to their own understanding ability, time and other factors, and complete related exercises according to their mastery and understanding or record the problem.

(3) Classroom activities

1) Problem exchange
Complete the core of knowledge internalization when flipping classroom activities in the classroom. The communication, inquiry, and cooperation activities between teachers and students in the classroom are all effective ways to internalize knowledge. The issues of discussion and communication are no longer set by teachers, but must be jointly determined by teachers and students. Teachers put forward some questions based on the teaching content, key points, and difficulties, while students put forward unsolved problems based on the pre-class learning situation, and then focus on communicating and solving these problems. It can also be done in a group. If cooperation cannot be solved, Teachers will explain and demonstrate in detail.

2) Independent creation
In flipped classroom teaching, not all problems need to be solved through communication and discussion, but also need to focus on cultivating students' ability to complete tasks and solve problems independently. Because when students are thinking independently, the internalization of knowledge will really happen, and students can truly learn to use knowledge.

3) Teamwork
In order to cultivate students' sense of teamwork, in the flipped classroom teaching process, some challenging tasks can be set, which may not be completed independently, through the division of labor and cooperation of team members, exchanges and discussions are completed together.

Achievement exchange: The results here can be individual or group. The right to comment can be given to students or groups, so that students can share experiences, inspire each other, and inspire stronger learning motivation in the process of mutual evaluation.

2.4 Factors Affecting the Reliability of the Questionnaire Survey

(1) Number of entries
Assuming that the new entry has the same degree of representativeness as the original entry, when the number of entries increases to K times the original number, using the Spearman-brown formula, the reliability obtained is:

\[ p = \frac{kr}{1+(K-1)r} \]  

Where r increases the current reliability of the article.

(2) Sample size
With other conditions unchanged, the larger the sample size, the more information about the
population contained, and the more accurate the estimated reliability. However, if the sample size is too large, it will increase the workload of the investigation, cause systematic errors, and reduce the validity. Assuming that the reliability of the given quantification table before the study is R and the half width of the confidence interval of the overall reliability is CI, use the formula to estimate the corresponding required sample size n.

\[
  n = \left(\frac{Z_a}{Z(R) - Z(R + CI)}\right)^2 + 3 \tag{2}
\]

\[
  Z(R) = \frac{1}{2} \ln \frac{1 + R}{1 - R} \tag{3}
\]

Where Z is the Fisher-z transformation.

3. Investigation and Research of Flipped Classroom Teaching Experiment Under the Background of Subject Reform Based on Information Technology

3.1 Questionnaire Design

After using the flipped classroom teaching model for teaching practice, this article issued a questionnaire on the effects of flipped classroom teaching to students in a certain university in this city. In order to confirm the effect of flipped classroom teaching, the design of the questionnaire is mainly based on research hypotheses, and the relevant survey test questions are compiled from the three aspects of independent learning ability, classroom activity link effect, and learning effect.

3.2 Experimental Data Collection

A total of 200 questionnaires were distributed this time, among which the subjects included college students and teachers. 184 questionnaires were returned, of which 178 were valid questionnaires, with an effective rate of 89%.

4. Investigation and Analysis of Flipped Classroom Teaching Experiment Under the Background of Subject Reform Based on Information Technology

4.1 Students’ Autonomous Learning Ability

This article is aimed at asking students how many times they need to watch instructional videos to complete pre-class tasks. The survey results are shown in Table 1.

| Number of learning | Boys  | Girls |
|-------------------|-------|-------|
| 1 time            | 15.3  | 13.2  |
| 2-4 times         | 77.4  | 80.4  |
| 5-7 times         | 5.2   | 3.6   |
| 8 or more         | 1.2   | 2.0   |
| Unable to complete the task | 0.9 | 0.8 |

complete pre-class tasks
Figure 1. Survey and analysis of the number of times students watch instructional videos to complete pre-class tasks

The experimental survey results in Figure 1 show that 78.9% of students can complete autonomous learning through 2-4 times, 14.25% of students can even complete it by watching one time, and the proportion of students who need to watch more than 5 times or even more is not too big. I learned from the exchanges with students after class that students feel very relaxed about their autonomous learning before class.

4.2 Investigation and Analysis of Classroom Activities

Ask the students whether the communication and cooperation with the teacher in the classroom is helpful to complete the classroom tasks. The survey results are shown in Table 2.

Table 2. Effectiveness of communication and cooperation between teachers and classmates in the classroom

| Classroom effect | Boys  | Girls |
|------------------|-------|-------|
| helpful          | 82.5  | 88.4  |
| Ineffective      | 8.3   | 3.4   |
| Mediocre         | 9.2   | 8.2   |

Figure 2. The effect of communication and cooperation between teachers and classmates in the classroom
As shown in Figure 2, only 5.85% of students think it’s not helpful, and 8.7% of students think it’s sometimes helpful and sometimes not helpful. The results show that 85.45% of students think it’s helpful. Communication activities between students are still necessary, and students can gain something from the exchange and cooperation.

5. Conclusions
The main purpose of the teaching practice research in this article is to verify whether the flipped classroom teaching model is effective in improving students' learning efficiency, independent learning ability, practical operation ability, and problem solving ability in the elective module courses of information technology classroom. The teaching practice of the flipped classroom teaching model proves that compared with the shortcomings of the traditional teaching model in the past, it is indeed effective to a certain extent. Especially for improving learning efficiency, students' independent learning ability, problem-solving ability, etc., it has a relatively significant promotion effect, and basically achieved the expected research goals.

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