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Project-based teaching in primary and secondary school information technology courses application

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Abstract: With the release of the new curriculum standards, the information technology course in the compulsory education stage has been renamed as the information technology and science course. This also indicates that in computer education, both information and technology are emphasized, and more attention is paid to the cultivation of students' higher-order thinking and innovation ability. In the past, information technology education focused more on the cultivation of students' information literacy. However, with the promulgation of the new curriculum standards, more emphasis is placed on the cultivation of students' core subject literacy. How to cultivate students' core subject literacy has become a focus of attention. The rise of project-based teaching mode provides an important support and inspiration for the cultivation of students' core literacy.

1. Introduction

Since the release of the first version of the Information Technology Curriculum Standards, China's information technology education has focused on students' information literacy, emphasizing the cultivation of their ability to operate and apply computers. However, the 2017 version of the "High School Information Technology Curriculum Standards" explicitly introduced the concept of core subject literacy and its cultivation requirements, which mainly include four aspects: information awareness, computational thinking, information social responsibility, and digital learning and innovation. In the latest "Compulsory Education Information Technology Curriculum Standards" released in 2022, the cultivation requirements for students' core subject literacy in the compulsory education stage were clearly defined, with a greater emphasis on cultivating students' higher-order thinking, digital literacy, and innovative thinking and abilities. It is no longer about rote memorization of knowledge and mechanical operation of computer software, but rather about enabling students to understand the knowledge and apply it to solve real-life problems. Based on this, it is necessary to select appropriate teaching methods and approaches to be applied in computer education to better meet the requirements of cultivating core subject literacy. In recent years, project-based teaching has been widely used in various subjects, and it has been more frequently applied in practical subjects like information technology with good results. Therefore, this article intends to briefly discuss the combination of project-based teaching and information technology courses based on the cultivation of students' core subject literacy, summarize its advantages and disadvantages, and propose areas for

improvement.

2. The Connotation of Core Literacy

The latest "Compulsory Education Information Technology Curriculum Standards" released last year clearly defined the core subject literacy for primary and secondary school students, including information awareness, computational thinking, information social responsibility, and digital learning and innovation. Information awareness aims to cultivate students' sensitivity to information and their ability to judge the authenticity of information, which can to some extent foster their information security awareness and national security awareness. Computational thinking is about cultivating students' ability to use computer science methods to decompose, abstract, and model problems and produce results. Digital learning and innovation refers to cultivating students' ability to assess and select appropriate digital devices, platforms, and resources in their daily learning and life, effectively manage the learning process and resources, conduct inquiry-based learning, and creatively solve problems. Information social responsibility refers to the responsibilities that individuals should fulfill in terms of ethics, behavior norms, and cultural cultivation, which is an essential quality for every qualified member of society[1]. It also points to information security awareness and national security awareness. These four aspects constitute the requirements for students' literacy in the network space, which are essential qualities and key abilities that support the cultivation of students' development literacy.

3. Theoretical Basis of Education

3.1. Pragmatism Theory

The American educator John Dewey proposed a teaching model contrary to that of traditional educators like Herbart. Dewey advocated student-centeredness, believing that students are the true masters of the classroom, and teachers should act as facilitators and promoters to help students learn better. In addition, Dewey also put forward the ideas of "education as experience," "education as life," and "school as society." Among them, "education as experience" emphasizes that Dewey values imparting direct experience to students rather than indirect experience. Indirect experience is generally the experience summarized by predecessors in books,[2] which is difficult for students to understand and very boring. In contrast, imparting direct experience means transmitting knowledge derived from our daily actual life to students, allowing them to directly obtain it through hands-on operation and experience, which is more acceptable to students. "Education as life" emphasizes that teaching should be closely related to students' daily lives and return to their lives, so as to connect with students' existing experiences and stimulate their interest and initiative in learning. The school is society emphasizes that the prototype of the school is actually society, and the life in school should be closely related to social life and cannot be separated from it. In fact, the knowledge that students come into contact with or learn in school is all for preparing for future life.

3.2 Constructivist Theory

Scholars of constructivist theory advocate that learners actively learn to construct their own cognitive structures. In this process, they particularly emphasize the dominant position of students and fully mobilize their initiative. At the same time, constructivism also attaches great importance to the cultural background, that is, the construction of the learning environment. Through cooperation with peers and with the help of learning materials, they connect existing knowledge and experience to construct meaning. [3]

4. Definition of Project-Based Teaching

Project-based teaching is an inquiry-based teaching model based on constructivism. [4] Students should not passively accept knowledge but participate in the cultural community to construct meaning.

The main characteristics of project-based learning are as follows. First, it can integrate learning content and goals, cultivate students' comprehensive abilities, and students can carry out cooperative learning around a specific subject, using knowledge from multiple fields to solve problems. Second, it is student-centered, emphasizing personalized learning and cooperative learning, and actively constructing knowledge systems. Third, teachers play an auxiliary role, mobilizing students' potential motivation. In the process of project-based teaching, teachers are leaders, managers, and facilitators, promoting students' autonomous and cooperative learning. Therefore, in the application process, these characteristics should be fully considered and the project-based teaching model should be reasonably applied.

5. Application Status of Project-Based Teaching Model

5.1 Applicable Scope and Subjects

The project-based teaching model is almost applicable to all subjects and students at all educational levels. In the past, project-based teaching was often used more in universities and vocational colleges, which is closely related to the traditional teaching model in China. In the primary and secondary school stage in China, the teaching model is more teacher-centered, with teachers imparting knowledge to students. Students mainly consolidate knowledge by listening to lectures and completing exercises and test papers. Moreover, in the primary and secondary school stage, students' main task is to get admitted to higher education institutions, and teachers' main task is to help students master knowledge faster and more effectively and improve their grades and the school's admission rate. Therefore, it is difficult for teachers to spend a lot of time designing and implementing project-based teaching content. Because from design to final acceptance, it goes through six stages: scenario introduction, plan formulation, autonomous and collaborative implementation, guidance and inspection, presentation of results, and evaluation and testing. Therefore, the entire process takes a long time and is a huge challenge for both teachers and students. In contrast, in the university stage, teaching is more flexible, and the requirements for students are no longer to memorize knowledge mechanically but to be able to flexibly apply knowledge to solve practical problems, cultivate students' practical operation abilities and teamwork abilities, and prepare for future employment. Therefore, in such a context, project-based teaching is more applicable because its main features are teamwork and student-centered learning to promote students' learning. However, with the proposal of new curriculum standards and the continuous reform and development of education, project-based teaching models have also been widely applied in the primary and secondary school stage. In terms of subject application, it is almost applicable to all subjects. It is quite astonishing to see that many teachers in basic education of different subjects are conducting project-based teaching in their own subjects. What is particularly surprising is that even liberal arts subjects can use project-based teaching to cultivate students' learning interest and cooperative learning ability. Traditionally, subjects like Chinese, history, and politics are believed to be mastered merely through memorization and recitation. However, adopting this approach makes students find these courses dull and uninteresting. Nowadays, with project-based teaching in liberal arts courses, the curriculum becomes rich and interesting. For instance, in English classes, project-based teaching can be used to stage dramas, which not only makes the process enjoyable but also enhances students' oral communication skills. Project-based teaching is even more widely applied in science and engineering subjects, especially in practical subjects like computer science, where its appropriate application can yield better results.

5.2 Application Background

The traditional information technology curriculum focuses on systematic learning, with task-driven teaching methods mainly designed around how to systematically learn software. Teachers often delve deeply into the functions of various software but pay insufficient attention to the true purpose of learning software, that is, the core literacy of the subject. This lags behind the requirements of the new curriculum reform. Developing core literacy involves applying learned knowledge to form concepts and methods; it is the basic values, essential qualities, and important abilities that individuals demonstrate when facing complex and uncertain situations in an informationized, globalized, and learning-oriented society while dealing with practical problems. Project-based learning is a teaching method that takes projects as the main line, with teachers as guides and students as the main body.[5]

5.3 The Compatibility of Project-Based Teaching and Information Technology Courses

The first major concept in the information technology curriculum standards is to adhere to moral education and cultivate new people of the times with digital literacy. Here, digital literacy refers to the core literacy mentioned in the curriculum standards, including information literacy, computational thinking, digital learning and innovation, and information social responsibility. The focus is on cultivating students' higher-order thinking and the ability to solve real-life problems, which are also their essential qualities and key abilities. In project-based teaching, there is a clear theme, and this theme is jointly established by students and teachers. Moreover, project-based teaching clearly stipulates that students are the main body of project-based learning, and they complete the project independently with their group members. It can be seen that to a certain extent, this can cultivate students' sense of responsibility. In project-based learning, students are required to comprehensively apply knowledge from various fields to solve problems. However, students' abilities and knowledge domains are limited, so they need to search for resources online to obtain the desired knowledge. In information technology courses, information literacy and digital learning and innovation aim to cultivate students' ability to obtain information and their ability to distinguish the authenticity of information and exchange information resources. These two aspects are highly compatible. At the same time, in project-based learning, another important feature is that there is a tangible outcome after teaching, which is very useful for cultivating students' computational thinking. Because computational thinking involves students decomposing, abstracting, modeling, and finally producing a work. Through this process, students' computational thinking is cultivated. Therefore, it can be seen that project-based teaching is highly compatible with cultivating students' computational thinking.

5.4 Limitations of the Project-Based

Teaching Model In project-based teaching, although practical investigations show that it can indeed enhance teaching efficiency, there are still some limitations. Project-based teaching places extremely high demands on students because it is a student-centered learning process, and most of the time, students complete tasks independently. However, it is not difficult to notice that during this process, students' self-discipline, sustained focus on learning, and abilities are limited and cannot be maintained at a high level. Therefore, this poses a challenge for students.

The difficulty of the projects designed by teachers in project-based teaching is uncertain for students. Many teachers in basic education tend to overlook students' experience levels when designing projects, resulting in overly difficult tasks. This may cause students to feel frustrated when they encounter difficult problems that are hard to solve during the exploration process. Therefore, teachers should pay attention to this issue when designing and formulating projects.

Project-based teaching also places extremely high demands on teachers, putting many of them in

an overloaded state[6]. Many teachers have multiple roles, not only as subject teachers and class advisors but also as project designers. As a result, teachers have complex roles and heavy workloads, making them feel overwhelmed and exhausted, and thus unable to guarantee the quality of project design.

6. Problems and Reflections on the Application of Project-Based Teaching Model in Information Technology Courses

6.1. Difficulty in Systematic Knowledge Learning during Project-Based Learning

In project-based teaching, knowledge points are mainly decomposed into different activities within various projects, which leads to the knowledge points being overly fragmented and difficult to learn systematically. Therefore, how to systematize knowledge points during project-based learning has become a challenge and a focus of attention. Currently, some scholars have found that knowledge graphs can be used to summarize and integrate knowledge points.

6.2. Low Student Participation in Project Design in Project-Based Teaching

In project-based teaching, the design of projects is almost always completed by teachers alone, including the theme and concept. However, often, the themes selected by teachers have a certain gap with students' cognition or experience base, which can lead to unsatisfactory results in the implementation of the entire project. Therefore, how to motivate students and involve them in the design and formulation of projects is also a problem worth paying attention to. The main solution to this problem is to allow students to add some personalized designs during the implementation of project teaching or incorporate different creative ideas when sharing their works. However, in actual practice, there are still problems such as difficulty in motivating students and a gap between the personalized creative designs added and students' cognitive experiences.

6.3. Incomplete Recording of the Project-Based Learning Process

During the project-based learning process, due to the relatively long duration of the project, a large amount of resources are generated, especially students' learning performance and works. However, currently, there are still very few platforms capable of recording these resources. Currently, the main method is to save works in folders, but this approach is prone to the loss of works. Therefore, in future research, more attention should be paid to developing a management platform that can record the process of project-based learning.

7. Conclusion

This study primarily employs theoretical analysis to explore the application of project-based teaching in information technology courses at primary and secondary schools, as well as its advantages and disadvantages. Project-based teaching can effectively enhance students' practical skills, innovative thinking, and teamwork abilities. It also facilitates the integration of information technology courses with real-world problems, thereby increasing students' learning interest and initiative. Moreover, it assists students in mastering information technology knowledge and skills, and cultivates their comprehensive qualities such as problem-solving abilities, critical thinking, and self-directed learning capabilities, which are of significant importance for adapting to the developmental demands of the future information society.

Future research could further investigate the integration of project-based teaching with other

pedagogical methods and how to optimize the implementation effects of project-based teaching through technological means (such as artificial intelligence, virtual reality, etc.). Additionally, designing more targeted project tasks to meet the learning needs of students at different levels and conducting teaching practice research are also worthwhile topics for in-depth exploration.

In summary, project-based teaching provides a new instructional model and approach for information technology courses in primary and secondary schools. It is hoped that more educators will pay attention to and practice this method, jointly promoting the innovation and development of information technology education.

References

[1] Li Juan, Li Hongbo, Su Dan, Li Zi, Tan Kun, Li Xin. Project-based Teaching Reform and Practice of Web Front-end Development Course [J]. Journal of Science of Teachers College and University, 2022, 42(10): 78-81.

[2] Ji Xinyan, Li Hongke, Zhao Rui. Research on Information Technology Teaching Design Based on Core Competencies of the Subject [J]. China Education Informationization, 2022, 28(07): 122-128.

[3] Qu Hongtao, Liu Rong. Design and Implementation of Innovative Project-based Learning Courses in Information Technology for Primary and Secondary Schools [J]. China Education Informationization, 2022, 28(06): 117-123.

[4] Tian Zhi, He Rensheng, Cai Mengqiu. Research Hotspots and Trends Analysis of Computational Thinking Based on Knowledge Graph [J]. Software Guide, 2018, 17(09): 9-12.

[5] Yang Xiaozhe, Liu Xin. Information Technology Curriculum for Compulsory Education Oriented towards Digital Literacy [J]. Global Education Outlook, 2022, 51(06): 109-117.

[6] Tong Huizhi. Research on the Application and Limitations of Project-based Teaching [J]. Journal of Jiangxi Electric Power Vocational and Technical College, 2018, 31(06): 32-33.