Project Learning: An Important Way for Students to Better Learn Information Technology Courses---- Take the Overview of Information Systems as an Example

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Abstract: The general high school information technology course is a basic course that high school students must master, and the new curriculum standard puts forward new requirements for the way students learn information technology courses, and advocates project-based learning methods. Taking the overview of the information system in the second chapter of the compulsory edition of high school information technology personnel teaching as an example, this paper constructs the teaching mode of the core literacy project of information technology discipline based on project learning from several aspects, such as mastering the characteristics of learners, selecting project content, forming driving problems, providing scaffold resources and establishing an evaluation system, and shows the specific application of this model in teaching.

Keywords: Project learning; High school information technology subject; Core literacy

1. Introduction

The 2020 Information Technology Curriculum Standards for General High Schools (2017 Edition and 2020 Revision) put forward new requirements for the teaching methods of IT courses, advocating students to use project-based learning methods to integrate knowledge building, skill development and thinking development into the process of using digital tools to solve problems and complete tasks. It can be seen that project-based learning is one of the important learning methods in information technology courses to cultivate students' core competencies, which can better promote students' learning. Through the learning method based on real projects, students independently construct knowledge, develop critical thinking, and improve problem-solving skills in the process of completing project tasks, so as to achieve the goal of cultivating students' core literacy.

2. Core literacy and project learning connotation

2.1 The connotation of core literacy of the discipline

The core literacy of disciplines is a concentrated embodiment of the value of discipline education, and is the correct values, necessary character and key abilities gradually formed by students through subject learning. The core literacy of information technology in high school is composed of four core elements: information awareness, computational thinking, digital learning and innovation, and information social responsibility. [1] They are the comprehensive expression of information technology knowledge and skills, processes and methods, emotional attitudes and values gradually formed by high school students in the process of receiving information technology education.

2.2 Project learning connotation

Project-Based Learning, guided by constructivist learning theory, emphasizes students' inquiry and learning in a real environment, thereby enhancing students' diverse abilities. [2] Project-based learning starts from challenging real-world problems or situations, emphasizing situationality, collaborative communication, support of cognitive tools, creative products and continuous inquiry, which has become an important way to cultivate students' core literacy. [3] It pays great attention to students, focusing on guiding students to conduct research on social focus issues or practical related problems, and actively collecting information, acquiring knowledge and exploring solutions. [4] In the project learning practice, students can not only integrate the knowledge of various subjects, but

also cultivate problem-solving skills, teamwork ability, independent learning ability and other skills through project-based tasks. As a result, project learning changes the way students learn, improves the quality of students' learning, and further promotes the development of students' thinking.

2.3 Exploration of the learning and teaching mode of high school information technology curriculum project based on the core literacy of the subject

To implement project learning in the classroom, project design and implementation based on "subject core competencies" is an effective project learning strategy. This project takes Chapter 2 "Overview of Information Systems" of the compulsory 2 "Information Systems and Society" of high school information technology personnel teaching as an example to carry out project-based learning, and arranges 4 lesson hours. In the first lesson, through the analysis of the smart campus project, experience the intelligent air conditioning system, master the concept of information system, and explore the basic structure and key elements. In the second lesson, through the analysis of the smart campus project, build an automatic temperature measurement system and understand the development process of the automatic temperature measurement system. In the third lesson, analyze the automatic temperature measurement system that has been built, understand its working process, and optimize the automatic temperature measurement system. In the fourth lesson, the project team demonstrated and communicated, analyzed the advantages and limitations of the information system by analyzing the small information system that has been built in the smart campus project, and understood the type, function and future development trend of the information system in combination with other common information systems in life.

3. Mastery of learner characteristics is the basis for project development

This lesson is aimed at first-year high school students, who have the following characteristics: the first-year students can understand the concept of information system and apply it in the construction process of "automatic temperature measurement system", can reasonably use programming symbols, and can psychologically control several variables when solving complex problems, while considering several other variables; Senior students through the first chapter of information technology and society learning, students have a certain understanding of information technology and its applications, and master the origin and basic characteristics of the information society, know how to choose appropriate information technology tools to solve practical problems, in the brain formed a certain knowledge and experience system, in the study of this course, students under the guidance of teachers, the learning content and the existing cognitive structure, actively build a new cognitive structure, meaningful learning; In daily life, students in the first year of high school often use information systems to solve various problems, and have a certain understanding of the information society, but they do not understand the composition and key elements of information systems, and need to use teachers' explanations and guidance and independent learning and inquiry to deeply feel the convenience brought by information systems to learning and life. The "automatic temperature measurement system" in this lesson deepens the difficulty after students understand the concept and composition of the information system, so that students can operate it and explore independently. Through the previous physics class, students have mastered the basic method of connecting circuits, and can prevent circuit connection errors when building open source hardware.

4. The rational selection of project content is the basis for the success of the project

Projects should start from problem solving and design "real" learning activities. [5] Good project design involves three elements: the challenge of the project setting, the integration of learning content, and the openness of students' learning styles. [6] Starting from the smart campus system in students' school life, this project divides the smart campus system into different subsystem projects, and students independently choose the topics of the small projects they are interested in to build and design small information systems. The following is an introduction to the "Smart Campus" project:

4.1 Project introduction

The smart campus system is to realize the effective integration, integration and optimization of various resources on campus through information means, realize the effective allocation and full use of resources, and optimize and coordinate the school management process. With the support of technologies such as Internet of Things and environmental perception, mobile Internet and mobile applications, social networks and learning collaboration, all kinds of campus equipment, classrooms, teaching platforms, etc. can be combined with students and teachers as an organic whole, and the smart campus system provides corresponding support for various activities such as teacher teaching, student learning, and campus management. The smart campus system includes subsystems such as academic affairs system, intelligent air conditioning system, automatic temperature measurement system, broadcasting system, student management system, and library management system. These subsystems can be relatively independent modules or components, which are organically combined to form a larger and more complete information system, the following two systems are

described:

(1) Automatic temperature measurement system: As a place with high crowd density, the campus has become one of the important places for epidemic prevention and control. The use of automatic temperature measurement system can make temperature measurement simple and efficient, avoid cross-infection between teachers and students, and play an important role in campus epidemic prevention and control. Students measure their body temperature when entering the school gate, and if the temperature measurement sensor is abnormal, the system will automatically send specific information to the campus epidemic prevention officer for rapid processing.

(2) Intelligent air conditioning system: hot or cold weather will affect the learning effect of students in the classroom, multimedia classrooms are equipped with intelligent air conditioning, air conditioning can test the temperature of the air to automatically raise and lower, so as to give students and teachers a good and comfortable learning and working environment.

4.2 Project objectives

(1) Deepen the understanding of the basic structure and key elements of the information system by building subsystems in the smart campus system. (Computational Thinking)

(2) Understand the development process of subsystems in the smart campus system, understand the working process of information systems, and realize that information system development is a systematic process. (Digital Learning and Innovation)

(3) Understand the types and functions of common information systems in life, analyze the advantages and limitations of information systems and future development trends. (Information Awareness)

(4) Recognize that developing information systems is a complex process and enhance respect for information system developers. (Information Social Responsibility)

4.3 Project selection

Students form a group of 3~6 people, choose a reference topic independently, or draft a topic of interest to carry out project learning. The reference topics are as follows: dissecting and building an automatic temperature measurement system, profiling and building an intelligent air conditioning system or dissecting and building an automatic ringtone system.

5. The setting of project-driven questions is the key to the development of the project

The project needs to be guided by driving questions to stimulate students' interest in learning. [7] The driving issues of this project consist of three parts: basic questions, unit problems, and content problems. The basic question is an open-ended question, there is no single definitive answer, and it is a bad problem. The content problem involves the basic concepts and principles of this chapter, which is the basic knowledge that students need to master, and belongs to the problem of good construction. Unit problems communicate basic problems and content problems, become a bridge between basic problems and content problems, and promote students' independent inquiry of projects. Under the guidance of driving questions, students comprehensively use the knowledge of various disciplines to solve problems, produce interdisciplinary learning behaviors, and promote the formation of complex thinking. [8] The driving problems of this project are shown in the figure:
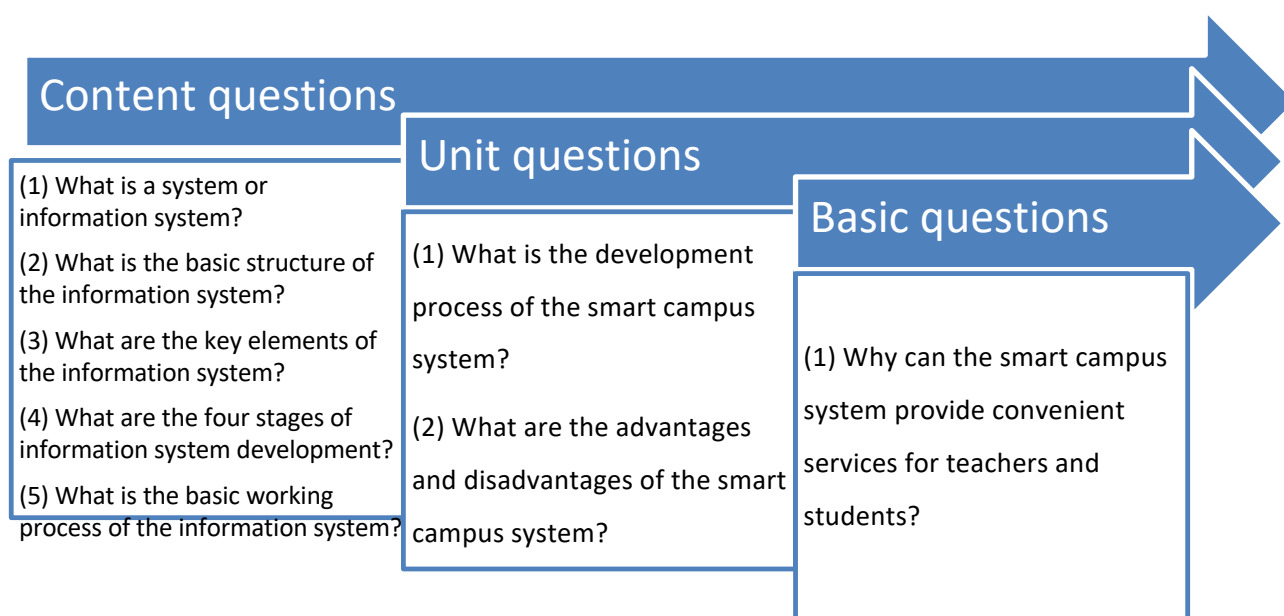
Content questions

(1) What is a system or information system?

(2) What is the basic structure of the information system?

(3) What are the key elements of the information system?

(4) What are the four stages of information system development?

(5) What is the basic working process of the information system?

Unit questions

(1) What is the development process of the smart campus system?

(2) What are the advantages and disadvantages of the smart campus system?

Basic questions

(1) Why can the smart campus system provide convenient services for teachers and students?

Figure 1　Project-driven issues

6. The provision of scaffold resources is the support for the promotion of the project

In the project-based information technology course teaching, scaffold resources should be effectively used to support students' open learning to promote the occurrence of students' deep learning. [9] With the support of project scaffolds resources, students use digital tools to apply knowledge, develop computational thinking, and improve digital learning and innovation capabilities. Teachers provide learning task lists as scaffolds for students' learning, and learning task lists include scaffold resources such as mind maps, tables, and achievement examples. This project also provides the corresponding platform as a scaffold, and the corresponding scaffold resources are introduced below.

6.1 Mind Maps

Taking the construction of intelligent air conditioning system as an example, students can freely form teams according to the projects they are interested in, clarify the tasks of project exploration, consult relevant materials to carry out exploration, and finally form works and evaluate. By completing the project tasks, students analyze the structure of the intelligent air conditioning system in the form of a mind map, and summarize the basic structure of the information system, the structure analysis diagram of the intelligent air conditioning system is shown below.
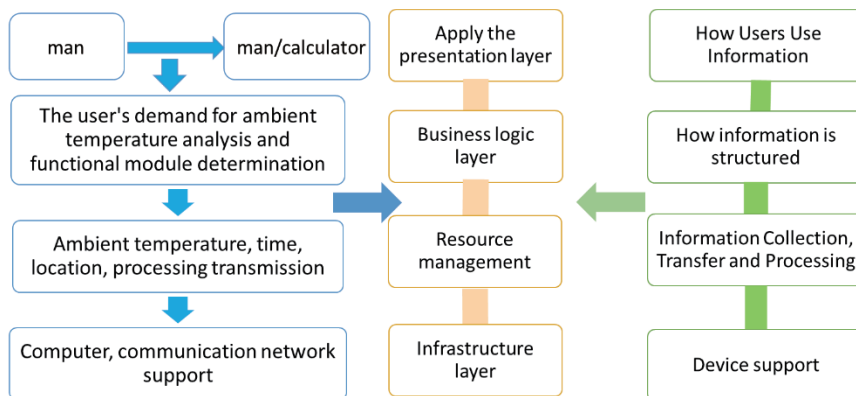

Figure 2　Structural analysis diagram of intelligent air conditioning system

6.2 Forms

In the process of group project learning, the table can be used to construct knowledge independently, taking the intelligent air conditioning system as an example, students think about the smart air conditioning workflow and independently complete the structure configuration table of the intelligent air conditioning system.

Table 1　Structure configuration table of intelligent air conditioning system

Basic structure	Configuration instructions
Infrastructure layer	Sensors, displays, wires, networks, computers, etc
Resource management	Information sensed by sensors, information released by the control panel, etc
Business logic layer	Demand design and software application of intelligent air conditioning
Apply the presentation layer	Interactive

6.3 Mind+ programming platform

Mind+ is a domestic youth programming software with independent intellectual property rights. Mind+ integrates a variety of mainstream motherboards such as micro:bit, Leonardo, Arduino Uno, Arduino Nano and other motherboard-controlled devices, can connect works to the physical world, and supports AI image recognition, speech recognition, translation, Internet of Things (IoT) functions, students can drag blocks for graphical programming, and can also use high-level programming languages such as Python.

6.4 Mind+ open source hardware

Taking the construction of intelligent air conditioning system as an example, through project-driven problems, building intelligent air conditioning system needs to understand the working principle of intelligent air conditioning system, that is, intelligent air conditioning uses temperature sensors to detect the temperature of the environment, high temperature LED light bright blue indicates cooling, too low temperature LED color light red indicates heating, moderate temperature LED color light

bright green. The project can be broken down into three subtasks, first of all, when the hardware connection of the smart air conditioning system, students need to use the Arduino Uno main control board, temperature sensor, and RGB lights in the Mind+ artificial intelligence suite to build the smart air conditioner according to the prompts. Connect the LCD1602 module to the corresponding I2C interface, in the order of red, black, blue and green, red to 5V, temperature sensor connected to analog pin, LED color light connected to digital pin. Secondly, the programming of the intelligent air conditioning system. After the students complete the construction, write the code according to the teacher's prompts and upload it to experience the workflow of the smart air conditioning system, and the key part of the code is shown in the figure below. Finally, test and run the smart air conditioning system and adjust the smart air conditioning system program.

7. The setting of the evaluation rubric is the guarantee for students to achieve their learning goals

The achievement of project learning objectives requires setting a reasonable evaluation rubric. When students carry out self-evaluation or other evaluations of project achievements, they need to carry out in-depth reflection and give reasonable suggestions according to the evaluation rubric, from different angles and levels combined with the actual performance of group members, and evaluate the project. Different types of assessment help students develop critical thinking, learn from the strengths of other students, and make up for their own shortcomings. The setting of the project learning evaluation scale starts from the aspects of students' learning emotions, learning attitudes, participation and cooperation in the classroom, completion of works and group collaborative learning, combined with students' self-evaluation, group evaluation and teacher evaluation, to provide a favorable guarantee for students to understand their own learning situation, timely adjust their learning progress and achieve project goals.

In short, the cultivation of the core literacy of information technology in high school needs to achieve the overall improvement of the core literacy of information technology discipline in the process of project learning through project learning. Teachers need to master the methods of project design from the perspective of core literacy of the subject, design projects reasonably, and cultivate students into Chinese citizens with high information literacy.

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