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Research and Practice of Panoramic Teaching Mode Based on Mind Mapping: Taking the Course "Principle and Application of Single - Chip Microcomputer" as an Example

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Abstract: Aiming at the existing problems in the current teaching of single-chip microcomputers, this paper deeply explores the application of the panoramic teaching mode based on mind maps in the teaching reform of single-chip microcomputers. In the teaching process, through the form of mind maps, teaching resources in different modes and forms, including texts, pictures, videos, simulations, physical objects, etc., are integrated, and the relationships among the knowledge points contained in the resources are sorted out, which is beneficial for students to have a corresponding macro-level understanding of the course while mastering specific knowledge points. In the teaching process, the panoramic teaching mode is adopted, with students as the center, focusing on guiding students to learn independently, carry out cooperative learning in groups, and explore the design methods of innovative projects and comprehensive projects. By mobilizing teaching resources in multiple forms, both online and offline, students' ability to perceive knowledge is stimulated, and their innovative thinking and engineering application ability are cultivated.

Keywords: Mind map; Panoramic teaching mode; Teaching reform

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1. Introduction

With the development of science and technology, teachers no longer rely solely on traditional blackboard writing. Instead, they have shifted to multimedia teaching that includes various forms such as texts, graphics, animations, videos, and voices. However, the general framework of the course knowledge is mainly presented in the form of a table of contents and chapters in textbooks. Yet, the small knowledge points within the chapters and the relationships among these knowledge points are not visible at a glance, which is not conducive to students' learning and the cultivation of their application abilities. Therefore, how to effectively integrate various forms of course resources, how to better organize the complex knowledge points, how to carry out teaching centered around students, and how to transform from knowledge indoctrination to ability cultivation are of great research significance.

Facing the above problems, the panoramic teaching mode based on mind maps provides an effective solution. Taking the course "Principle and Application of Single-chip Microcomputer" as an example, this project enables students to comprehensively understand and master the knowledge they have learned through mind maps and panoramic teaching, combines learning with real life, stimulates students' interest in learning, promotes the maximization of teaching effects, and helps students comprehensively master and apply the knowledge they have learned. In the teaching process, through the form of mind maps, teaching resources in different modes and forms, including texts, pictures, videos, simulations, physical objects, etc., are integrated, and the relationships among the knowledge points contained in the resources are sorted out, which is beneficial for students to have a corresponding macro-level understanding of the course while mastering specific knowledge points. Panoramic teaching can arouse students' vivid memories and certain experiences by solving problems related to real life and production. It transforms students' implicit learning into explicit learning, which is more conducive to students' transformation from theoretical learning to practical application. The conclusions formed by solving real problems are also more likely to be transferred, more likely to be consciously applied in future practices, and become conscious actions, thus cultivating students' innovative ability and engineering application abilities [1].

2. Design of the course mind map

A combinatorial mind map is designed for the course "Principle and Application of Single-chip Microcomputer." Taking the textbook as the most fundamental starting point, several learning scenarios with expandability and covering the key contents of the course are created to provide students with learning resources in various modes and forms, as shown in **Figure 1**. Questions with certain regularity, which are applicable in all learning scenarios and centered around the core cultivation objectives of the course, are designed to guide students to think. Students are guided to conduct exploratory research by optimizing the solutions to some problems in the textbook, using multiple solutions to solve the same problem, and comprehensively utilizing multiple knowledge points to solve complex problems. Each link of the panoramic teaching is continuously optimized and improved according to students' learning effects and teachers' classroom teaching effects, as shown in **Figure 2**. Students are guided to use the knowledge they have learned for innovative design and comprehensive design to apply what they have learned and explore, and innovate.

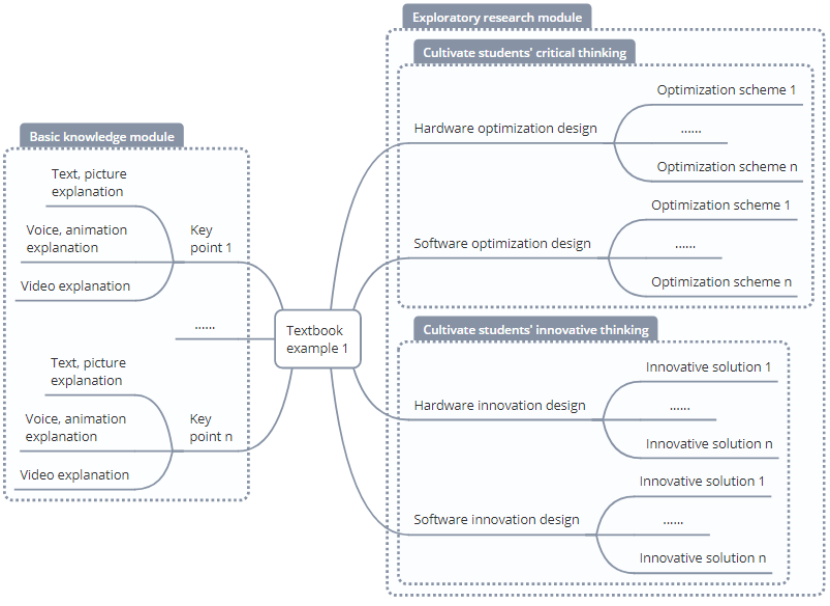

Figure 1. Example of a mind map with the textbook example as the central theme.

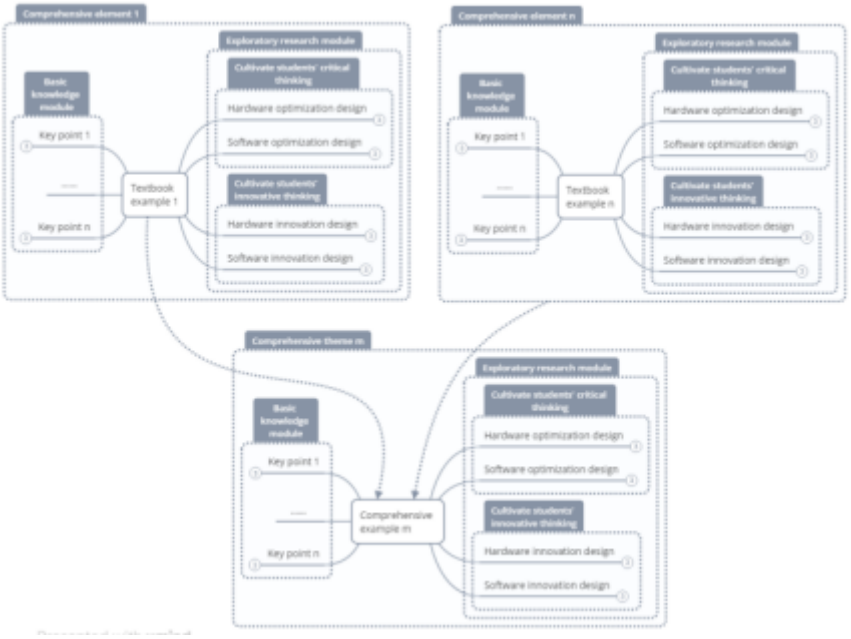

Figure 2. Example of the overall mind map of the course.

3. Panoramic teaching mode design

3.1. Overall design concept

Practice the panoramic teaching mode, focusing on students' learning effects with students at the center. Firstly, provide students with the knowledge points in the textbook and relevant basic cases as basic materials. At the same time, equip them with teaching resources in different modes and forms to help students visualize abstract knowledge. Then, guide students to improve the cases in the textbook, cultivate students' critical thinking, and pursue the quality of excellence. Next, when students have finished learning multiple knowledge points, through comprehensive engineering cases from real life [2], such as the design of elevator control panels, the design of sound and light prompt systems for the running state of subways, the design of commercial water dispenser control systems, the design of intelligent household appliance control panels, the design of waveform generators, the design of voltmeters, etc., bring real-life experiences to students by calling on information resources such as videos and simulation results. Finally, provide students with innovative materials, guide students to discover other engineering examples around them, use the provided comprehensive engineering case materials as a stepping stone, independently connect real-life situations with the theoretical knowledge points in the textbook, and through group discussions, extract the key points from the basic materials and comprehensive materials, conduct innovative independent design after summarizing and thinking, as shown in **Figure 3**.

The panoramic teaching can associate boring knowledge points with the real world. Through online and offline learning [3], basic materials, improved materials, comprehensive materials, and innovative materials are provided to students to improve students' design success rate and enhance their sense of accomplishment in learning. Throughout the teaching process, students can intuitively feel the visualization process and the results of knowledge points in engineering applications. Through group cooperation, discussion and communication, summarization and thinking, it can stimulate all students' perception abilities, improve students' learning enthusiasm, and thus effectively improve learning efficiency.

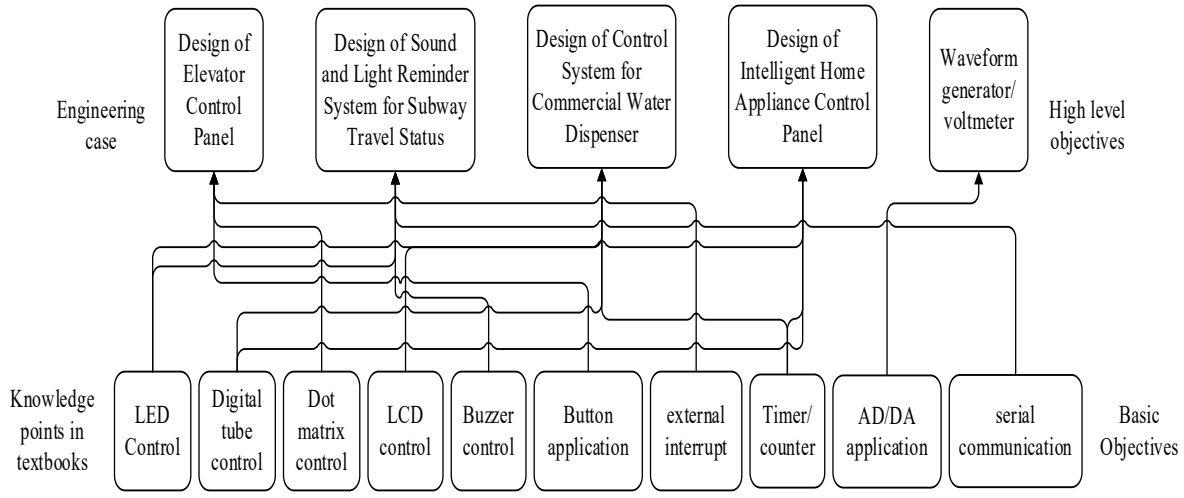

Figure 3. The overall idea of the teaching reform.

3.2. Specific operation steps

(1) Case design preparation

Design different types of cases, including basic cases, improved cases, comprehensive cases, and innovative cases [4]. Each case can provide students with design materials [5,6]. The cases must have a framework structure. Carefully design the blank parts that require students to think about in the key sentence parts. Utilizing virtual simulation tools [7–9] and modifying the key sentences in the materials, students can gradually and intuitively feel the changes in the design results before and after the modification, and understand and experience the application methods of the key design elements.

(2) Basic case practice

Extract the knowledge points from the textbook and provide students with course resources in various forms such as texts, pictures, videos, animations, and simulations [10]. Enable students to master the application of a single knowledge point through self-study and achieve the design effects of the cases in the textbook through simulation tools [11,12].

(3) Improved case practice

Taking the skill requirements of hardware engineers, software engineers, and test engineers as the framework, centered on students [13], guides students to improve and optimize the basic cases in the textbook. For example, change the hardware circuit diagrams to modular design, use subroutine calls in software, and conduct tests using simulation instruments and meters.

(4) Comprehensive case practice.

By simulating the scenes of common comprehensive engineering cases in real daily life, and through means such as multimedia and simulation technology, let students simulate the roles of engineers and carry out hardware and software design and system debugging [14]. By simulating real engineering application scenarios, students can experience the engineering application process of multiple learned knowledge points during hands-on practice, thus breaking the limitations of a single knowledge point and helping students establish a panoramic understanding of the course.

(5) Innovative case practice

Guide students to actively discover engineering application cases around them, broaden their thinking, and boldly transform the hardware design, software design, and testing methods in the basic materials,

improved materials, and comprehensive materials. Establish design cases with certain innovation and differences from the materials, and form new application cases of the learned knowledge.

(6) Summary and exhibition

Set several stage points in the panoramic teaching course. Through students' analysis, improvement, discussion, and summary, the formed phased achievements are presented in the whole class in the form of groups. Excellent design works are included in the next round of the teaching case library, thus enhancing students' sense of accomplishment, contributing to the teaching cases, and forming a virtuous cycle of mutual promotion between teaching and learning.

4. Summary and prospect

Practice has proven that the panoramic teaching mode based on mind maps is an effective teaching method, which can help students better master the relevant knowledge and practical skills of single-chip microcomputer design. In the simulated real engineering application scenarios, students can master the application of each basic knowledge point and get familiar with the actual engineering design process. In the teaching process, not only are students taught theoretical knowledge and their basic skills in single-chip microcomputer design are trained, but also their innovative thinking and engineering application abilities are cultivated, and the quality of single-chip microcomputer teaching is improved [15].

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Disclosure statement

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