The Core Content of Physics Teaching in Higher Vocational Colleges and the Presentation Mode of Instructional Materials from the Perspective of Knowledge Structure

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Abstract: This article mainly discusses the importance of knowledge structure in physics teaching in higher vocational colleges (HVC), and analyzes the optimization strategy of its instructional content and instructional material presentation. This article expounds the importance of HVC education and the position of physics in HVC education, and points out the existing problems in HVC physics teaching, such as the disconnection between theory and practice, and the unclear knowledge structure system. In order to solve these problems, from the perspective of knowledge structure, this article deeply analyzes the core content of HVC physics teaching and the presentation mode of instructional materials. Specifically, this article constructs the theoretical framework of the research by combing the theoretical basis of knowledge structure, the core content of HVC physics teaching and the presentation mode of instructional materials; Then, the practical exploration scheme is designed, and the corresponding countermeasures are put forward in view of the challenges encountered in the practice. This article provides strong theoretical support and practical guidance for the reform of HVC physics teaching, which is helpful to improve the physical literacy and comprehensive ability of HVC students.

1. Introduction

In today's society, with the rapid development of science and technology and the continuous optimization and upgrading of industrial structure, higher vocational education, as an important bridge connecting education and industry, theory and practice, has become increasingly important [1]. HVC education is not only responsible for cultivating high-quality skilled talents for the society, but also one of the key factors to promote economic and social development and enhance national competitiveness [2]. Under this background, the teaching quality and effect of various subjects are directly related to students' future career development and the overall progress of society [3].

As the foundation of natural science, physics plays a key role in HVC education [4]. Physics not only provides students with a scientific method to understand the basic laws of nature, but also cultivates students' logical thinking, experimental operation and problem-solving ability, which are very important for students' subsequent professional study and career [5]. However, at present, there are many problems in HVC physics teaching, such as the disconnection between theory and practice and the unclear knowledge structure system, which seriously affects the teaching effect and students' interest in learning [6]. Therefore, from the perspective of knowledge structure, it is particularly important to deeply analyze the content of HVC physics teaching and the presentation of instructional materials [7]. By optimizing the knowledge structure, students can better build a physical knowledge system and understand the internal relations between physical concepts, thus improving learning efficiency and interest [8]. At the same time, the reasonable presentation of instructional materials can also promote students' absorption and application of physical knowledge and cultivate students' innovative ability and practical ability [9].

The purpose of this study is to put forward targeted improvement suggestions through in-depth analysis of the presentation mode of HVC physics instructional materials in order to improve the quality and effect of HVC physics teaching. This research is not only of great significance to improve the physical literacy and comprehensive ability of HVC students, but also can provide useful reference for HVC education reform. By reforming the physics teaching mode, we can better meet the needs of social development, cultivate more high-quality skilled talents with innovative spirit for the society, and thus promote the sustainable development of HVC education.

2. Knowledge structure and the core content of HVC physics teaching

2.1. Theoretical basis of knowledge structure

Knowledge structure, as an important concept in cognitive psychology and pedagogy, refers to the organization and internal relations of knowledge in individual minds [10]. It emphasizes that knowledge does not exist in isolation, but is interrelated and forms a system. In HVC physics teaching, knowledge structure theory provides us with an important perspective to understand how students learn physics and how to build a physical knowledge system [11]. Through in-depth study of knowledge structure, teachers can better grasp the internal logic of physics knowledge, thus designing a more reasonable teaching plan and helping students master physics concepts effectively.

2.2. Identification of the core content in HVC physics teaching

The core content of HVC physics teaching is the basic knowledge and skills that are very important for students' subsequent professional study and career development. By combing the curriculum standards and instructional materials, we can identify these core contents. Table 1 specifically shows the core content of HVC physics teaching.

Table 1 Core Content of Higher Vocational Physics Teaching

Core Content Category	Specific Content
Mechanics	Fundamentals such as particle mechanics, rigid body mechanics, and fluid mechanics; Basic principles including the concept of force, laws of motion, and energy conservation
Thermodynamics	Laws governing thermal phenomena and thermal motion; Contents like the first law of thermodynamics, the second law of thermodynamics; Basic concepts including temperature, heat, and internal energy
Electromagnetism	Phenomena such as electric charge, electric fields, magnetic fields, and electromagnetic interactions; Basic knowledge in electrostatics, constant magnetic fields, and electromagnetic induction
Optics	Phenomena such as the propagation, interference, and diffraction of light; Basic content in geometric optics and wave optics
Modern Physics	Basic concepts and principles of modern physics, such as quantum mechanics and relativity
Experimental Skills	Fundamental skills in conducting physics experiments, including measurement, observation, and data processing
Problem-Solving Abilities	The ability to apply physical knowledge to solve practical problems

2.3. Core content optimization strategy

From the perspective of knowledge structure, it is needed to pay attention to the coherence of knowledge in order to optimize the core content of HVC physics teaching. Teachers can organize and present physics knowledge according to its inherent logic by constructing knowledge map and adopting modular teaching, so as to help students form a clear knowledge framework. Teachers can also pay attention to the transfer and application of knowledge, and guide students to apply the learned physical knowledge to the solution of practical problems, thus deepening their understanding of knowledge.

3. Presentation of knowledge structure in HVC physics textbooks

3.1. Theoretical basis and current situation analysis

As an important carrier of teaching, the presentation of instructional materials directly affects the learning effect of students. The theoretical basis of textbook presentation mainly includes cognitive load theory and constructivism learning theory. These theories emphasize that instructional materials should conform to students' cognitive laws, pay attention to the hierarchical and progressive knowledge, and students' active participation and construction process. In HVC physics textbooks, a reasonable presentation should be able to guide students to understand physics knowledge step by step and form a complete knowledge system. At present, there are some problems in the presentation of HVC physics textbooks, as shown in Figure 1:

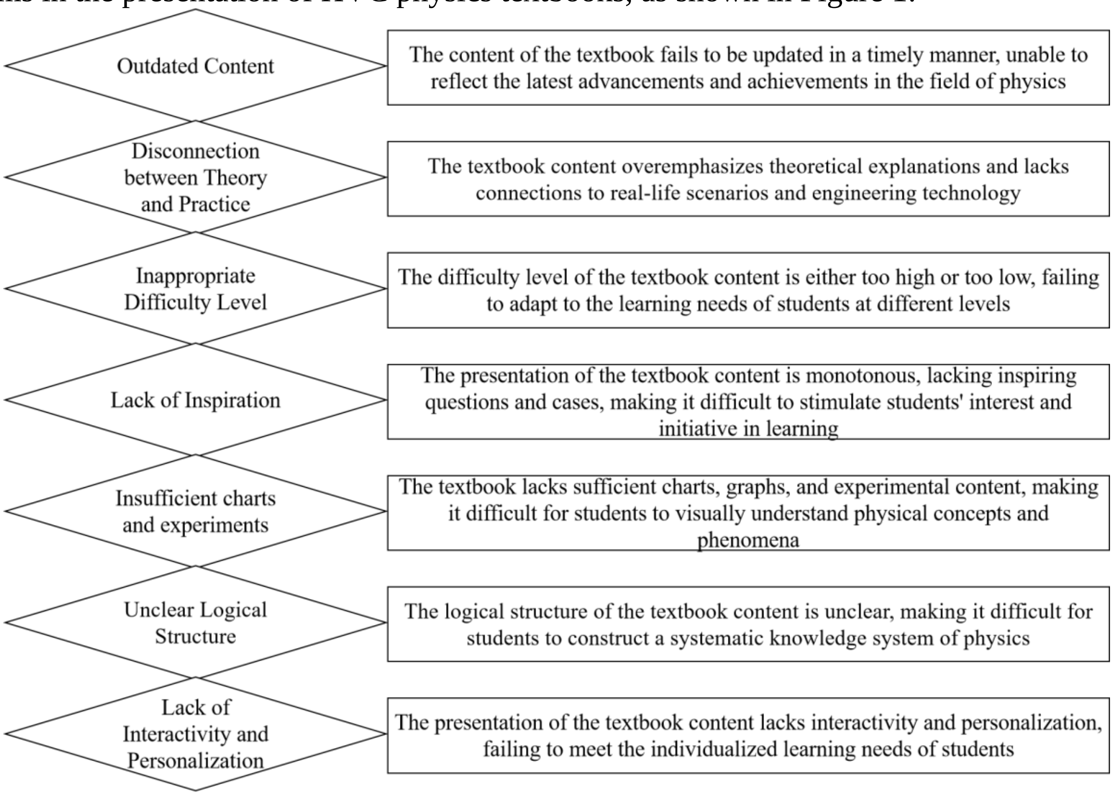

Figure 1 Problems existing in the presentation of HVC physics textbooks

These problems make it difficult for students to form a clear knowledge framework in the learning process, which affects the learning effect. Some textbooks pay too much attention to the instillation of theoretical knowledge and ignore the importance of experimental operation and practical application, which leads to the failure to effectively cultivate students' practical ability and innovation ability.

3.2. Instructional material presentation strategy of knowledge structure optimization

In order to optimize the presentation of HVC physics textbooks, the following strategies can be adopted from the perspective of knowledge structure: First, teachers need to pay attention to the systematization and coherence of knowledge, and guide students to learn physics knowledge step by step by building knowledge modules and setting guiding questions. Secondly, teachers should strengthen the combination of theory and practice, pay attention to the introduction of experimental operation and practical application, and improve students' practical ability. Finally, teachers should pay attention to the interest and interaction of instructional materials, and stimulate students' interest in learning by designing interesting experiments and interactive links. Through the implementation of these strategies, it is believed that HVC physics textbooks which are more in line with students' cognitive laws and pay attention to practical application can be created.

4. Practical exploration and case analysis

4.1. Practical exploration scheme design

After deeply understanding the theoretical basis of knowledge structure, the core content of HVC physics teaching and the presentation mode of instructional materials, this section designs a practical exploration scheme. This scheme selects students with different professional backgrounds and learning abilities as the research objects to ensure the universality and representativeness of the research results. By using the method of comparative experiment, the subjects were randomly divided into experimental group and control group, and the number of students in each group was equal to ensure the fairness of experimental conditions.

The optimized knowledge structure was adopted in the teaching of the experimental group. First of all, according to the core content of HVC physics teaching and the theoretical basis of textbook presentation, the instructional content has been reorganized and arranged, highlighting the internal relationship and hierarchical structure of knowledge. At the same time, clear teaching objectives are set to ensure that teaching activities are targeted. In the teaching process, teachers should pay attention to guiding students to actively explore and cooperate in learning. The control group followed the traditional instructional method, that is, teaching in the original order of the instructional materials, focusing on instilling and memorizing knowledge. In order to ensure the effectiveness and reliability of practical exploration, the experimental conditions, including teaching time and teaching environment, are strictly controlled, and the learning effects of the two groups of students are compared. The results are shown in Table 2:

Table 2 Comparison of Experimental Results on the Effectiveness of Higher Vocational Physics Teaching

Group	Average Score (out of 100)	Proportion of Increased Interest in Learning	Proportion of Positive Learning Attitude	Proportion of Deep Understanding of Physical Concepts
Experimental Group (Optimized Knowledge Structure)	85	70%	85%	90%
Control Group (Traditional Teaching Method)	70	30%	60%	70%

By comparing the data of the experimental group and the control group above, it can be clearly seen that optimizing the knowledge structure has a positive effect on improving the effectiveness of HVC physics teaching.

4.2. Challenge and countermeasures

In the process of practical exploration, we have encountered challenges such as great differences in students' foundation, limited teaching resources and single teaching assessment method. In view of these challenges, corresponding countermeasures have been taken. For example, in view of students' basic differences, the hierarchical instructional method is adopted, which provides personalized learning paths for students at different levels. In view of the limited teaching resources, we actively use network resources and digital teaching tools to enrich teaching means and resources. In view of the single teaching assessment method, a diversified assessment mechanism is introduced, and students are comprehensively evaluated from the aspects of knowledge mastery, skill improvement and innovation ability.

5. Conclusions

From the perspective of knowledge structure, this study deeply analyzes the content of HVC physics teaching and the presentation of instructional materials. Through theoretical discussion and practical exploration, the following conclusions are drawn: the optimization of knowledge structure can significantly improve the effect of HVC physics teaching and help students better build a physics knowledge system. At the same time, the reasonable presentation of instructional materials can also promote students' absorption and application of physics knowledge; The challenges encountered in practical exploration can be effectively solved through targeted countermeasures. These conclusions provide powerful theoretical support and practical guidance for HVC physics teaching reform.

Although some research results have been achieved, there are still some shortcomings: due to the complexity and variability of the teaching environment, the optimization strategy proposed in this study needs to be adjusted according to the actual situation. In the future research, we can also deeply study the specific influence of different knowledge structure optimization strategies on teaching effect, and provide more detailed guidance for HVC physics teaching reform. In addition, with the continuous development of educational technology, we can explore how to further optimize the knowledge structure and textbook presentation of HVC physics teaching by using new technical means.

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