

Reflections on the development of science essential education teaching materials for middle school physics under the leadership of core literacy

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Abstract: This paper examines the development of teaching materials for essential science education in junior middle school physics under the leadership of core literacy. The background is the importance of core literacy in modern education. The content includes the development process of teaching materials and the evaluation of implementation effect. The methodology is empirical research using case study and comprehensive assessment methods. The viewpoint is that the development of teaching materials based on core literacy promotes the overall development of students. Students' practical ability, problem solving ability and scientific attitude are improved through practical inquiry, problem solving and emotional attitude development. The research results show that the development of teaching materials based on core literacy for science essential education in junior middle school physics is of great significance for the comprehensive quality education of students.

Key words: core literacy; junior middle school physical science; development of teaching materials; assessment of implementation effect; comprehensive development

1 Introduction

In recent years, the education sector has put forward increasingly high demands for the cultivation of students' core literacy. As an important part of students' comprehensive development, core literacy covers knowledge, ability, attitude and values. In middle schools, physical science, as an important subject, plays a crucial role in the development of students' comprehensive literacy. Therefore, exploring the development of essential education materials for junior middle school physical science led by core literacy has become a hot topic in the current education reform.

The purpose of this study is to study in depth the relationship between core literacy and junior middle school physical science essential education, and explore how to incorporate the concepts and elements of core literacy into the development of teaching materials in order to enhance the comprehensive quality of students and the effectiveness of subject learning. Specific objectives include: (1) exploring the application value of core literacy in junior middle school physical science education; (2) analyzing the shortcomings of the existing teaching materials in the cultivation of core literacy; (3) proposing ideas and strategies for the development of teaching materials for essential education in junior middle school physical science, which are led by core literacy. Through the implementation of this study, it is expected to

provide useful thinking and reference for the development and improvement of junior middle school physical science education teaching materials, further promote the optimization and innovation of education teaching materials, and enhance the learning effect of students and the cultivation of core literacy.

2 Core literacy and science essential education in junior secondary physics

2.1 Meaning and objectives of junior middle school physical science essential education

Junior middle school physical science essential education aims to cultivate students' basic knowledge of physical science, scientific thinking and the ability to apply the methods of the discipline, as well as to cultivate students' scientific attitudes and values. Through the study of physical science, students are able to understand the laws of nature, develop an interest in science and a spirit of inquiry, and improve their problem-solving skills, which can lay a solid foundation for further study and future career development. The objectives of the science essential education in junior secondary school physics include: cultivating students' scientific literacy, cultivating students' scientific thinking and sense of innovation, cultivating students' experimental and observational skills, and cultivating students' scientific inquiry ability.

2.2 Relationship between core literacy and junior middle school physical science essential education

Core literacy refers to the comprehensive literacy of interdisciplinary knowledge, skills, attitudes and values that students need in learning and life. Middle school physical science essential education has a close relationship with core literacy. First, core literacy provides a comprehensive framework covering subject knowledge, subject competence and subject thinking, which is compatible with the goals of junior middle school physical science essential education. Second, the core literacy focuses on cultivating students' innovation ability, problem-solving ability, as well as cooperation and communication ability, which are all important literacy needed in middle school physical science learning. At the same time, core literacy also emphasizes the cultivation of students' values and humanistic literacy, which helps guide students to form correct scientific attitudes and values. Therefore, the development of middle school physical science essential education teaching materials led by core literacy can better meet the needs of students' comprehensive quality cultivation and promote students' overall development [1].

3 Principles and methodology for the development of teaching materials

3.1 Development principles of teaching materials

In the process of developing teaching materials for the science essential education of junior middle school physics led by core literacy, the principles of subject essence, student development, discipline integration, practical application and diversification should be followed. These principles can ensure the quality of the content of the teaching materials and the improvement of the teaching effect.

The principle of the subject essence means that the content of the teaching materials should emphasize the essence and core concepts of the physical sciences, and focus on cultivating students' understanding of the essence of science and the development of scientific thinking. The principle of student development means that the content and design of the teaching materials should take into account the cognitive level, psychological characteristics and learning needs of students, and promote the overall development and personality development of students. The principle of discipline integration means that the teaching materials should integrate the physical sciences with other disciplines and promote the connection between disciplines and the cultivation of comprehensive ability. The principle of practical application means that the teaching materials should focus on practice and application, encourage students to conduct experiments, observations and investigations, and cultivate their practical abilities and problem-solving skills [2]. The principle of diversification means that the design of the teaching materials should be diversified, including different types of teaching resources, teaching activities and evaluation methods, in order to meet the diverse learning needs and the interest development of students.

3.2 Development methods of teaching materials

The first step in the development of teaching materials is to determine clear and explicit educational and teaching objectives. Educational and teaching objectives should be based on the requirements of core literacy and the essential education of junior middle school physical science, and the objectives of knowledge, ability and attitude that students need to achieve should be clearly defined.

In the development of teaching materials, teaching contents should be selected and organized according to the educational and teaching objectives. The selection of content should be close to students' daily life and practical applications, focusing on cultivating students' scientific thinking and problem-solving abilities, while maintaining the coherence and systematicity of the subject. The design of teaching activities should be diversified, flexible and inspiring. They can include experiments, discussions, inquiry activities, case studies, etc., to stimulate students' interest in learning, develop their cooperation and communication skills, and promote deeper learning and understanding.

The selection and utilization of teaching resources is an important part of the development of teaching materials. Teachers can combine a variety of resources, such as textbooks, multimedia teaching aids, experimental equipment, etc., to provide diversified learning materials and situations, and to enrich teaching content and methods. Teaching evaluation should be consistent with the educational and teaching objectives, and adopt diversified evaluation methods, including examinations, homework, laboratory reports, project presentations, etc., to comprehensively evaluate students' learning outcomes and the development of students' core literacy.

4 Embodiment of core literacy in science essential education teaching materials for junior secondary school physics

4.1 Practical inquiry

Practical inquiry is one of the important means to cultivate students' core literacy in junior high school physical science essential education. Through practical inquiry, students can conduct experiments and observations with their own hands, gain a deeper understanding of physical phenomena, and develop practical ability and scientific thinking.

Textbooks should be designed with diversified and interesting experiments and observation activities so that students can explore physical phenomena through hands-on practice. For example, in the process of learning optics, the experiment of light refraction can be designed to let students observe the law of light refraction by changing the angle of incidence of light and the refractive index of the medium. Through such practical activities, students can intuitively understand the principle of refraction of light. Practical inquiry is not only about conducting experiments, but also about developing students' ability to observe, record and analyze data. The textbook should guide students to learn how to observe experimental phenomena, record experimental data, and analyze and reason about the data. Through this process, students can develop critical thinking and scientific reasoning ability and gradually master the scientific method [3].

Practical inquiry cultivates students' spirit of inquiry and problem-solving ability. In the teaching materials, some open questions and challenges can be set to encourage students to solve problems through practice and thinking. For example, in the process of learning electric circuits, a problem can be designed: how to realize a circuit that can light up multiple light bulbs, so that students can design and build the circuit independently and explain its principles. Through such practical inquiry, students can develop problem-solving skills and creative thinking. Practical inquiry is not only to enable students to gain practical experience, but more importantly to develop students' practical ability, scientific thinking and problem-solving ability. Through rich experimental and observational activities, teachers can guide students to observe, record and analyze data, cultivating their spirit of inquiry and problem-solving ability, so that junior high school physical science education can better develop students' core literacy.

4.2 Problem solving training

Middle school physical science essential education textbooks should focus on problem solving training to develop students' core literacy. Challenging problems can be set up in the teaching materials to guide students to use the physical knowledge and scientific methods they have learned to analyze and solve practical problems. Through the process of problem solving, students can develop critical thinking, innovative thinking and cooperative problem solving skills to improve their core literacy.

4.3 Emotional attitude cultivation

In the middle school physical science essential education textbook, the cultivation of emotional attitude is an important aspect to develop students' core literacy. The teaching materials should guide students to actively participate in learning, cultivate their interest and love for physical science, and stimulate their desire to explore science. At the same time, the teaching materials should also pay attention to the cultivation of students' scientific attitudes, such as scientific spirit, cooperation and respect, in order to improve students' core literacy [4].

5 Case study: practice of developing teaching materials for science essential education in junior secondary school physics based on core literacy

5.1 Development process of teaching materials

In the process of developing teaching materials for middle school physical science essential education based on core literacy, the following key steps need to be experienced.

5.1.1 Formulating the objectives and principles for the development of teaching materials

Before starting to develop the teaching materials, the objectives and principles of the teaching materials need to be clarified, which include determining the focus of core literacy development and clarifying the core competencies and literacy goals that students should possess. At the same time, it is necessary to take into account the nature of the subject, student development and the principle of subject integration to ensure that the content of the teaching materials is compatible with the curriculum standards and the cognitive development of students.

5.1.2 Writing and designing the content of teaching materials

In developing and designing the content of teaching materials, the cultivation of core literacy needs to be integrated into it. The content of the teaching materials should be close to the nature of physical science, focusing on the construction and understanding of concepts. At the same time, rich and diverse practical activities should be designed to encourage students to conduct experiments, observations and investigations, so as to develop their practical skills and scientific thinking. The textbooks should also provide diversified evaluation methods to comprehensively assess students' learning outcomes.

5.1.3 Cultivating emotional attitudes

Apart from the cultivation of knowledge and abilities, the teaching materials should also emphasize the cultivation of emotional attitudes. By guiding students to actively participate in learning activities, they can cultivate their interest and love for physical science [5]. Cases and problems with social significance and practical applications can be incorporated into the teaching materials to stimulate students' thinking and desire for exploration. At the same time, emphasis should be placed on the cultivation of students' scientific attitudes, including the development of critical thinking, scientific method and scientific ethics.

5.1.4 Repeated revision and review

After the textbooks are prepared, repeated revisions and reviews are needed to ensure the quality and teaching effectiveness of the textbooks, which include discussions with teachers, experts and other education practitioners and

feedback from them, as well as careful review and revision of the materials. Through continuous improvement and refinement, it is ensured that the teaching materials can better meet the learning needs and training objectives of students.

5.2 Assessment of the implementation effect of teaching materials

In the process of implementing the core literacy-based middle school physical science essential education teaching materials, systematic assessment is needed to understand the implementation effect of the teaching materials. The assessment can adopt quantitative and qualitative methods, and comprehensively consider the indicators of multiple aspects.

5.2.1 Quantitative assessment

(1) Assessment of teaching performance: analyzing students' mid-term and final examination results and comparing the changes in students' performance before and after the implementation of core literacy teaching materials in order to assess the impact of the teaching materials on learning effectiveness.

(2) Survey on students' learning interests: Through questionnaires or interviews, students' interests and preferences for the content of the textbooks are collected to understand the impact of the textbook on students' motivation.

5.2.2 Qualitative assessment

(1) Observation of classroom teaching: Teachers and researchers can observe the degree of students' participation, thinking ability, and practical operation during the teaching process in order to assess the effect of the teaching materials on the cultivation of students' practical ability and scientific thinking.

(2) Student discussion and feedback: Through student discussion and group work, we can understand their mastery and application of the teaching materials, and collect their feedback and suggestions on the teaching materials in order to assess the effectiveness of the teaching materials on the cultivation of students' core literacy.

The analysis and summary of the assessment results provide reference for further improvement and optimization of the teaching materials. Based on the assessment results, the content of the teaching materials can be revised and adjusted in response to students' learning needs and feedback in order to improve the implementation of the teaching materials and the effectiveness of teaching.

6 Conclusion

The development of teaching materials for science essential education in junior middle school physics based on core literacy is an important way to promote the overall development of students. In the process of textbook development, following the principles of subject essence, student development, subject integration, practical application and diversification can ensure the quality of textbook content and the improvement of teaching effect. At the same time, the textbooks embody important aspects of core literacy, such as practical inquiry, problem solving and the cultivation of emotional attitudes, so as to improve students' core literacy by cultivating their practical ability, problem solving ability and scientific attitudes. During the implementation of the teaching materials, systematic assessment can be conducted to understand the effectiveness of the implementation of the teaching materials and provide reference for further improvement and optimization. Therefore, the development of science essential education teaching materials for junior middle school physics based on core literacy is an effective way to promote the overall development and quality education of students, and is of great significance to the cultivation of students with innovative spirit, critical thinking and practical ability.

Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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