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Curriculum Design and Teaching Practice of Middle School Chemistry from the Perspective of Subject Core Competence

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ABSTRACT
This paper reviews the five key dimensions of chemistry core competence, and on this basis discusses its value orientation in curriculum design, and reveals the underlying problems in the implementation of core competence in chemistry teaching from the perspectives of educational concept, teaching method, practice and experiment teaching. The paper also puts forward specific implementation paths for the problems, including the renewal of the human-oriented education concept, the application of diversified teaching modes, the construction of practical teaching system and the strengthening of inquiry and experiment links, aiming to provide theoretical support and practical guidance for the effective integration of the chemistry core competence through systematic teaching design and implementation strategies.

KEYWORDS
chemistry core competence; curriculum design; teaching practice; middle school chemistry

The proposal of the chemistry core competence marks the transformation of middle school chemistry teaching from the single knowledge transfer to the diversified integration of ability cultivation, value shaping and knowledge application. However, in the current middle school chemistry teaching practice, there are still problems such as lagging idea, single method, weak experiment and practice links, which seriously restrict the effective implementation of core competence. In this context, how to systematically optimize the curriculum design, integrate the chemistry core competence into teaching practice, and realize the deep integration of inquiry learning, practical ability training and emotional and values education has become an important topic to promote the innovation of chemistry education in middle schools.

1 The Content of Core Competence in Middle School Chemistry

According to the General High School Chemistry Curriculum Standard (2017), the five major components of the core competence of middle school chemistry include macro identification and micro analysis, changing concept and equilibrium theory, evidence reasoning and model cognition, scientific inquiry and innovation consciousness, and scientific attitude and social responsibility[1].

From the perspective of core competence, chemistry education should focus on the multi-dimensional ability construction, and deeply understand the characteristics and change rules of chemical substances through the perspective of combining macro and micro views. It also should examine the equilibrium and transformation in the chemical processes with the dynamic concept of change, and perform logical reasoning and establish scientific models based on evidence to develop students' rigorous analytical thinking.

The ability of scientific inquiry guides students to pay attention to the hypothesis and practice in the experiment process, an the sense of responsibility deepens students' understanding of the relationship between chemistry and society. Core competence aims to enhance students' adaptability and creativity to face the future society, and emphasizes that education should not only deepen the knowledge accumulation, but also shape emotions and value systems. Curriculum design should combine practical inquiry and humanistic care, and pay attention to the close connection between chemistry and the real world, so as to enhance the comprehensiveness and application of learning.

2 The Important Value of Middle School Chemistry Curriculum Design and Teaching from the Perspective of Subject Core Competence

2.1 Break the Traditional Education Pattern and Reshape the Education "Ecosystem"

The cultivation of subject core competence emphasizes the placing of knowledge, ability and values at the same level, which subverts the single mode of "knowledge-centered" in traditional education. In the curriculum design based on the subject core competence, chemistry teaching do not only focus on the indoctrination of knowledge, but builds a new

educational form through the cultivation of ability and the penetration of values. In the classroom, chemical knowledge, as a medium for students to expand their thinking, gradually forms students' three-dimensional cognition of the chemistry world, transforms students from passive knowledge recipients to active knowledge builders, and thus strengthens the openness and practicability of the classroom.

2.2 Improve the Teaching Level of Teachers and Promote Professional Development

The introduction of the perspective of core competence sets a new standard for the development of teachers' professional competence. The core competence-oriented design of middle school chemistry curriculum requires teachers to have systematic curriculum understanding ability and higher level of teaching organization. In this educational model, teachers should not only impart chemical knowledge, but also design diversified and hierarchical learning tasks according to the needs of different students, so as to promote the comprehensive development of core competence[2]. In addition, the increasingly diversified curriculum design directly promotes teachers' in-depth exploration in teaching research. Based on the continuous teaching reflection and strategy optimization, teachers' professional level can be gradually improved.

3 Current Situation of Neglect of Core Competence in Chemistry Teaching in Middle School

3.1 The Educational Concept is Lagging Behind and Cannot Stimulate Students' Subjectivity and Thirst for Knowledge

In the curriculum design and teaching of chemistry, the solidification of educational concept leads to the deviation of the development direction of core competence. Some teachers are still accustomed to taking knowledge points as the starting point and end point of teaching, and limit the course content to a single path of "memory-output". This philosophy treats students as passive receivers of knowledge, and ignores their depth of engagement and need for exploration in the learning process. In the curriculum design, students' personalized development space is compressed, learning activities often lack flexibility, and the classroom atmosphere is boring. In addition, the comprehensive cultivation of ability and emotion advocated by the subject core competence is separated, and the unidirectional transmission in the classroom suppresses students' curiosity about the nature of chemistry. Although the students complete the superficial learning of knowledge in the state of lack of initiative, the creativity and independent learning spirit emphasized in the core competence gradually fade away in this process.

3.2 The Teaching Method is Single and Difficult to Stimulate Students' Interest in Learning

The single teaching method is becoming an obstacle to the implementation of subject core competence. In the lecture-oriented classroom, students often accept knowledge passively, and there is a lack openness and interaction in the teaching process. Many teachers rely too much on textbooks when designing chemistry curriculum and restrict the advancement of the course strictly to the linear expansion of the theoretical content[3]. In the face of complex chemical concepts, it is difficult for students to feel the charm of chemical principles because of the lack of real situational experience. In addition, due to the lack of classroom interaction, students lack the opportunity to participate actively, and can not perceive the interest and application value of chemistry. Under this single teaching mode, it is difficult to cultivate the scientific inquiry and critical thinking advocated by the core competence, which leads to the gradual decline of students' learning interest.

3.3 Practice Teaching is Weak and Neglects the Teaching Function of Practice Link

In many middle school chemistry curriculum design, experimental teaching is still regarded as an auxiliary link, rather than the core part of teaching. Students have little exposure to chemical experiments, and practical courses are often compressed or even omitted due to time, resources or equipment constraints. Even when experimental classes are arranged, some teachers tend to complete teaching objectives through demonstration experiments rather than encouraging students to practice.

This kind of teaching mode neglecting practice makes students lose the opportunity to apply chemical knowledge in real situations, and makes it difficult to deepen the concept of chemistry in practice. Students who lack practical experience find it difficult to transform theoretical knowledge into practical ability when facing complex problems, and the abilities of experimental inquiry and solving practical problems, which are emphasized in the subject core competence, are even more difficult to be reflected.

3.4 Students Lack the Active Learning Awareness and are Difficult to Mobilize the Subjective Initiative

In the chemistry curriculum, the solidification of students' learning methods makes it difficult to fully mobilize the subjective initiative. Under the influence of traditional teaching concept, the classroom is mainly taught by teachers, and students are mainly responsible for accepting and memorizing. The curriculum design lacks the dynamic adjustment of individual students, and the singleness of learning activities reduces the willingness of students to participate. Subject core competence advocates students to play an active role in the learning process. However, in many classrooms, students tend to mechanically absorb and memorize chemical knowledge rather than actively explore and question it. The depth of thinking and the breadth of learning required by the core competence are almost impossible to talk about under this learning mode, so that students' understanding of knowledge stays at a superficial level, and they do not have the internal driving force to explore the true value of chemistry.

4 Curriculum Design and Teaching Methods of Middle School Chemistry from the Perspective of Subject Core Competence

4.1 Renew the Educational Concept and Establish the Concept of Human-oriented Education

In the process of implementing the subject core competence, the innovation of educational concept should run through every link of the chemistry curriculum. Teachers should deeply understand the requirements of curriculum standards for core competence, and change the classroom from a single knowledge transfer to the cultivation of multi-dimensional ability. For example, at the beginning of the classroom design, an open goal framework can be set to simultaneously promote the cultivation of knowledge points, emotional attitudes and values. According to the individual differences of students, teachers can use the way of preliminary investigation to understand students' interests and existing knowledge structures through questionnaire or interview, and form a data analysis report, so as to lay the foundation for teaching students according to their aptitude. In the classroom implementation stage, teachers can connect relevant knowledge points through a "problem chain" to integrate abstract chemical reactions into real situations, such as the discussion on the design of "oxide reaction paths in air pollutants", thus stimulating students to analyze macroscopic phenomena from the perspective of micro-chemistry[4].

4.2 Innovate Teaching Methods and Improve Teachers' Professional Quality

In middle school chemistry teaching, teachers should take the initiative to try diversified teaching methods, in order to promote students' all-round development under the vision of core competence For example, situational teaching can focus on practical problems, and teachers can build life scenarios by using multimedia resources, such as introducing the theme of "energy crisis" to combine chemical knowledge such as the determination of the calorific value of combustible reactions with the application of new energy technology. Flipped classroom requires teachers to carefully design tasks before class.

For example, by making a video explaining the basic principles of oxidation-reduction reaction, students can preview before class and focus on the design and optimization of fuel cell experimental devices through teamwork in the class. At the same time, teachers can analyze their own teaching processes through classroom videos, reflect on the effectiveness of teaching methods, and gradually improve the curriculum implementation plan, so as to promote the effective penetration of core competence in teaching practice.

4.3 Strengthen Practical Teaching and Stimulate Students' Interest in Learning

Practical teaching design is the key to promote students' understanding and application of chemical knowledge. Teachers can combine practice teaching and practical problems closely based on the curriculum content.

For example, when learning "neutralization reaction", the activity of "exploring lactic acid content in commercially available yogurt" can be designed, so that students can complete task reports through data collection and experimental analysis. Off-campus practice is an important way to expand students' understanding of chemistry.

Teachers can organize students to visit chemical enterprises or sewage treatment plants, and assign research tasks in advance, such as understanding the specific steps of acid and base neutralization in sewage treatment, and requiring students to record relevant content and think deeply about the technical principles. Virtual laboratory is also an effective tool to improve the efficiency of practical teaching. Teachers can guide students to deduce and verify the reaction mechanism in the virtual environment with the help of the simulation platform[5].

For example, teachers can adjust variables in virtual experiments and requires students to predict changes in reaction rates and compare them with real data, so as to enhance the interaction between knowledge and practice.

4.4 Pay Attention to Experimental Teaching and Stimulate Students ' Enthusiasm for Inquiry

Chemistry experiment teaching needs to change from verification experiment to inquiry experiment. Teachers should pay attention to flexibility and challenge when designing experiments. For example, in the teaching of "metal activity sequence", teachers can design experimental tasks, that allow students to use common metals such as iron, aluminum, zinc, and acidic solutions in daily life to conduct experiments, and thus to observe the displacement reaction phenomenon and deduce the relative activity of metals. Experimental teaching should encourage students to operate independently and reduce teachers ' excessive intervention. Teachers can guide students to complete the construction of experimental equipment step by step to cultivate students ' ability of experimental design. During the experiment, teachers should guide students to record abnormal phenomena and try to solve the problem through literature review or peer discussion. For experiments with interdisciplinary content, such as energy changes in thermal reactions, teachers can introduce thermodynamic concepts in physics and guide students to analyze and solve problems from different disciplinary perspectives. After the experiment, teachers should organize students to summarize and discuss the failure points of the experiment, so as to stimulate students ' deep thinking and continuous learning interest.

5 Conclusion

To cultivate the chemistry core competence, the teaching idea should be changed from knowledge imparting to ability cultivation, and the curriculum design should pay attention to the main body status of students and the diversification of learning situations. At the same time, teachers should introduce the links of practical teaching and experimental inquiry to strengthen the practical application value of theoretical knowledge, so as to promote the all-round development of student ' ' learning ability and comprehensive quality. In the future, with the further improvement of the curriculum system and teaching methods, the implementation path of the chemistry core competence will be clearer, and its potential to promote the comprehensive development of students will be further released.

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