A study of chemistry laboratory teaching in secondary schools under the guidance of core literacy

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Abstract. Chemistry contains a large number of theoretical and abstract contents, especially chemistry laboratory teaching, which has certain complexity and danger, and is relatively difficult for students to learn. This paper analyzes the core literacy-oriented chemistry laboratory teaching in secondary school, discusses the connotation of core literacy, clarifies the significance of the development of core literacy in chemistry laboratory teaching in secondary school, and puts forward several strategies on how to cultivate students' core literacy in chemistry laboratory teaching.

Keywords: secondary chemistry laboratory teaching; core literacy

1 INTRODUCTION

Experiment is an important part of the knowledge system of secondary school chemistry, and at the same time, experiment is also an important method and means of teaching the chemistry subject at the secondary school level. With the deepening of the curriculum reform, the requirements faced by the chemistry classroom have gradually increased, and the "Chemistry Curriculum Standards for Compulsory Education (2022 Edition)" suggests that the core literacy should be prioritized, and that chemistry experiments should be used as an effective means to enhance students' scientific thinking and innovative spirit[1]. The Chemistry Curriculum Standard for General High Schools (2017 Edition Revised in 2020) also puts forward targeted and guiding requirements for chemistry laboratory teaching in secondary schools, and takes chemistry experiments as an important way and method to cultivate students' core literacy in the discipline of chemistry in high schools. Therefore, how to improve students' experimental level in chemistry laboratory teaching and how to improve students' core literacy in the experimental process is an important issue.

2 BASIC CONNOTATION OF CORE LITERACY

The European Union adopted a major educational reform in 2002, guided by core literacies, integrating lifelong learning strategies and defining literacy[2]. Research on core literacy in the United States is slightly different from that of other countries in that it

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focuses on the development of students' competencies. In 2007, the United States introduced the concept of "three core literacies", namely, learning and creative skills, information skills, media skills and technology skills, and life and career skills. [3]

In September 2016, the Ministry of Education released the Core Qualities for Student Development in China, pointing out that the development of students' core qualities is to cultivate students' necessary character and key abilities to adapt to the needs of lifelong personal and social development, as well as to cultivate students' correct values, emphasizing that the cultivation of "all-rounded development of the human being" is the core of the overall performance. It emphasizes the cultivation of a "well-rounded person" as the core, and comprehensively manifests the six major qualities of humanistic heritage and scientific spirit, learning to learn, healthy life, responsibility, practice and innovation.

Generally speaking, the connotation of core literacy includes various aspects such as knowledge, ability and attitude, while the extension involves students' overall development and social adaptability, emphasizing the lasting effects of specific contexts and knowledge. The ability to transform what is learned into problem-solving skills in specific contexts is called core literacy.

3 THE SIGNIFICANCE OF SECONDARY SCHOOL CHEMISTRY LABORATORY CLASS UNDER THE ORIENTATION OF CORE LITERACY

3.1 Deepen your understanding

Chemistry is a subject based on experiments, which belongs to the natural science subject curriculum in senior high school, and is an exploration of natural and social phenomena. During this period, students' physical and mental development stages are in an important period, and teachers should take advantage of this period to strengthen the guiding role of students and fully mobilize their potential for chemistry. At the same time, students could complete the challenging task through cooperative learning through active participation. [4]Experiments are intuitive and exploratory, and experiments under the guidance of core literacy can help students gain a deeper understanding of the basic concepts and principles of chemistry, and experience the process and phenomena of chemical reactions firsthand. For example, through the acid-base neutralization experiment, students can more intuitively see the color change and temperature change during the acid-base reaction process, so as to more deeply understand the principle of acid-base neutralization.

3.2 Cultivating a sense of creativity in students

Innovation is the key driving force for social progress and scientific and technological development, and the secondary school stage is the key period for the formation of students' innovative consciousness and ability. In experimental teaching, the teacher is no longer a mere knowledge transmitter, but a guide who guides students to explore,

discover and solve problems. Students are also no longer passive learners, but actively involved in the experimental process, through practical exploration, discovering problems, proposing hypotheses, designing experimental schemes, collecting and analyzing data, and finally drawing conclusions. Such a teaching method can help students form a positive and active learning attitude, stimulate their enthusiasm for exploring the unknown, and then cultivate their innovative thinking and practical ability.

3.3 Cultivating students' interest in learning

The study shows that the learning environment and atmosphere significantly influence the degree of students' knowledge acquisition [5] Laboratory teaching provides students with opportunities for hands-on participation and experience. Compared with traditional classroom lectures, laboratory teaching can attract students' attention. Students in the experimental process students can not only verify the known chemical principles, but also try to explore the unknown phenomena and laws. This process of exploring the unknown can stimulate students' curiosity and desire for knowledge, and at the same time, in the process of carrying out chemistry experimental teaching centered on core literacy, it can make the concept of education in chemistry and the concept of core literacy organically integrated, which is conducive to the students' experience of participating in the fun of chemical experiments, and highlight the purpose and value of chemistry experimental teaching.

4 PRINCIPLES OF EXPERIMENTAL DESIGN IN SECONDARY SCHOOL CHEMISTRY UNDER THE ORIENTATION OF CORE LITERACY

4.1 Principle of harmonization of contextual and scientific aspects

This principle emphasizes that the design of experiments should be close to the reality of students' lives, but also ensure that the experiments are scientific and rigorous. The design of experimental teaching needs to follow the guidance of scientific theory and be based on the corresponding curriculum standards. The content of experimental teaching should be in line with the principles of chemistry as well as the actual teaching. The design of the experimental process should follow the characteristics of students' psychological development and cognitive level, aiming at allowing students to improve their core literacy in the experimental process. While focusing on the scientific nature, it is also necessary to combine scientific knowledge and real life, create a real teaching situation, and promote the level of students' chemical concepts and the level of scientific attitude and responsibility.

4.2 Principle of harmonization of cooperativeness and autonomy

In experimental teaching, it is necessary to cultivate students' cooperative ability as well as to respect and encourage their autonomy. Through cooperation, students can learn

from each other, exchange ideas and solve problems together; while autonomy can stimulate students' innovative spirit and desire for exploration, and promote their independent thinking and active practice. Teachers can first organize students to have group discussions and jointly design experimental programs. In this process, students need to give full play to their autonomy and put forward their own insights and suggestions. At the same time, students could complete the challenging task through cooperative learning through active participation. They also need to learn to listen to others' opinions and cooperate with their peers to improve the experimental program together. Such a cooperative process not only helps to develop students' communication skills and teamwork spirit, but also enables them to learn how to balance individual opinions and collective interests in practice.

5 STRATEGIES FOR TEACHING CHEMISTRY EXPERIMENTS IN SECONDARY SCHOOLS UNDER THE ORIENTATION OF CORE LITERACY

5.1 Creating life situations to cultivate the spirit of science

Chemistry comes from life, the integration of chemistry laboratory teaching and real-life situations can reduce the distance of students in the process of chemical experiments, knowledge and students closer to the distance, students can also bring their own life experience into the classroom, to expand the idea of experimental design, increase the interest and practicality of the classroom.

The creation of context method is generally used in the introduction phase of the experiment, in which the teacher's main purpose is to mobilize students' thinking and enthusiasm. Teachers can choose the living or interesting phenomena related to the curriculum as the introduction material, create a familiar learning situation for students, and guide students to reveal the experimental theme in the discussion. For example, when organizing and designing experiments related to acid-base reactions, the question "How to remove the scale in the kettle?" can be raised. This kind of life situation can stimulate students' desire for knowledge and exploration. In addition, teachers can also introduce students to the experimental situation through the introduction of chemical history, according to the experimental theme of the collection of relevant historical records, anecdotes, in order to broaden the students' knowledge of the history of chemistry reserves at the same time, but also to strengthen the students' cultural self-confidence and carry forward the outstanding traditional culture. For example, in the water purification experiment, you can introduce the introduction of ancient water purification methods in the canonical books, reenact the steps of water purification, the combination of ancient and modern, so that the students immersed in the charm of traditional culture, the development of students' core literacy.

5.2 Conducting inquiry experiments to develop a sense of inquiry

Exploratory experiment mainly refers to the teacher to chemical experiments as a carrier, according to the curriculum content to the students put forward the research problem, guide the students to peer groups as a unit, cooperative discussion to make experimental conjecture, design experimental program, through the experimental operation to solve the course problem. Exploratory experimental teaching can emphasize the subjectivity of students, the pursuit of cultivating students' scientific interest and inquiry ability. Through exploratory experiments, students can apply the theoretical knowledge of chemistry to experiments, and then cultivate the spirit of questioning and inquiry in the core qualities of chemistry.

For example, when teaching the content of chemical reaction rate, teachers can design an inquiry experiment, divide students into groups and let them observe the change of chemical reaction rate under different conditions. By changing the concentration of reactants, temperature and other factors, students can visualize the change in reaction rate and try to analyze the reasons. Such an experiment not only enables students to grasp the concept of chemical reaction rate, but also develops their observation, analyzing and teamwork skills.

5.3 Integration of information technology to foster scientific thinking

With the development of Internet information technology, the empowering effect of the Internet on education has become more and more obvious. Both the new junior high school curriculum and the new senior high school curriculum have repeatedly and explicitly mentioned the development of digital experiments in conjunction with information technology, affirming its important value for chemistry teaching. As a means of teaching in line with the development of the times, information technology allows students to carry out scientific investigation in experimental activities, and on the basis of promoting a deep understanding of the content learned, they can also feel the important value of technological advances and innovations in the science of chemistry, forming a rigorous, realistic and practical scientific attitude, and further implementing the development of the core qualities of the discipline of chemistry. Reasonable use of information technology can not only enhance teaching efficiency and assist in experimental operations, but also effectively stimulate students' interest in learning.

For example, in the experiment of ionic reaction, the teacher can use the conductivity sensor to measure the change of conductivity before and after mixing the solution with the help of hand-held technology, so as to understand the essence of ionic reaction in the solution and recognize the conditions for the occurrence of ionic reaction. With the help of information technology, the sensor can directly generate the conductivity change curve, in classroom teaching, let the students analyze the reasons for the formation of the curve, combined with macro phenomena and image curve to establish the concept of ionic reaction, improve the students' thinking level, symbols to characterize the thinking model of ionic reaction. Visualize the phenomenon that is not easy to observe, data, image, quantify the qualitative experimental phenomena, students are no longer passive acceptance of knowledge, but according to the image, data and logical

reasoning of the oxidation process and causes, so as to achieve the cultivation of the core literacy, and cultivate the scientific thinking of the students.

6 CONCLUDING REMARKS

To summarize, in the process of chemistry laboratory teaching in secondary school, teachers need to focus on guiding students to understand chemical knowledge at a deeper level, and also need to cultivate students' hands-on practical ability, and strive to improve students' core literacy. In this process, teachers should focus on guiding students to think independently and design and complete experiments on their own. In addition, teachers should add interesting exploratory experimental activities in the classroom teaching process to deeply stimulate students' enthusiasm for participating in chemistry learning activities, continuously enhance their learning ability, and improve students' core literacy.

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