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Research on Middle School Chemistry Teaching Design Based on Real Problem Situation

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ABSTRACT

In today's society, education in our country is showing an increasing trend of development. Chemistry, as a subject, has also made great progress. Most of the chemistry teaching models we remember from our childhood are to instil concepts, memorize concepts and ignore the combination of concepts with real-life situations, resulting in a mechanized and monotonous approach to learning chemistry. As a result, most secondary school students are not very good at chemistry. The reason for this is that chemistry is a very logical subject, and a large amount of chemical knowledge can be memorized by students using only one-sided words, which is still a challenge for them to understand. However, interest is the most valuable asset of children, therefore, this paper will be based on the existing information, and combined with the current theoretical research and development trend, in-depth discussion of the importance of the problem contextualized chemistry teaching, and through practical cases to explore how to better integrate the problem context into the chemistry classroom.

Keywords: Problem situation, High School Chemistry, Teaching design, Chemical education.

INTRODUCTION

Chemistry is a natural discipline that explores in depth the nature of matter, the laws of motion and their changes, which not only reveals the composition, properties and structure of substances, but also allows the discovery of new substances, thus advancing mankind's knowledge of the sciences and transforming them into tools for understanding and transforming the material world. As a discipline with a long history and strong vitality, the achievements of chemistry have become an important symbol of social civilization. However, in our conventional chemistry teaching, students are mostly in a passive position, with teachers lecturing directly, students taking notes and then deepening their understanding of the

concepts and memorization of knowledge through a large number of exercises in class. Obviously, this model is no longer applicable to today's classroom teaching, which not only ignores the student's subjective position, hindering the ability of students to find problems, thinking, problem solving, but also contrary to the construction of the student's knowledge system, affecting the students' in-depth understanding of chemical knowledge, which also leads to the learning of conceptual knowledge of the students to stay in the temporary memory level, which is due to the students' conceptual knowledge of the conceptual knowledge of the simple representation, and not incorporate the new concepts into the original knowledge. not incorporate the new concepts into the original knowledge system, without forming a complete and sound systematic structure [1].

Society is progressing and the education reform is getting better and better. Teachers should actively communicate with students in the classroom, develop with them, and while teaching knowledge, they should also pay attention to cultivating their thinking talent, encouraging them to ask questions, explore, reflect, and summarize in practice, so that they can learn more independently and individually under the guidance of the teacher. Teachers should also respect the cultivation of students' personality, pay attention to the individual differences of students, meet the learning needs of different students, and create an educational environment in which students can actively participate [2]· With the continuous development of high school students' theoretical thinking and the continuous improvement of their learning ability, their independent learning ability and self-control ability are significantly improved, and their observation, memory and thinking direction of things become clearer, and they begin to pay attention to their own future development and ideal planning, and they become more proactive and self-conscious in learning. The cognitive structure, emotion, personality and other psychological factors of high school students form a new situation of synergistic development, and their physical and mental development is constantly converging and maturing [3]. The teaching mode of real problem situation encourages students to actively participate in the chemistry classroom, contact their life related chemical experience, personal perception of the problem situation, and further into this learning atmosphere, which will undoubtedly cultivate students' interest in learning, and under the guidance of a problem situation, subconsciously develop their own knowledge construction system and improve their chemical learning ability.

MEANING AND DEVELOPMENT OF PROBLEM SITUATIONS

Problematic situations refer to a learning situation in which a student, faced with a new problem that he or she cannot understand, needs to overcome certain difficulties encountered in learning in order to understand the problem through a number of ways. In order to get out of this situation, it is necessary to develop new strategies for activities that have not been done before, i.e., to complete creative activities [4]. Problem situation means that the teacher consciously creates a variety of problematic activities to inspire the learner's thinking and research activities, so as to achieve creative activities. "Creating situations" can cultivate their spirit of inquiry and the ability to think independently, the teacher through the creation of the corresponding problem situation in different parts of the better understanding of students, knowledge acquisition, so as to achieve the purpose of "creating situations". Through the real problem situation, put forward the students concerned about the problem, can more easily stimulate students' interest and desire to explore, so that students' learning needs to be satisfied [5]. Integrating real situations into the classroom is equivalent to combining students' intuitive feelings about life (i.e. rational thinking) with abstract chemical knowledge (i.e.

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perceptual thinking). Students can intuitively feel and cause thinking about the problems in the context in the concrete situation, and the learning mode of students is transformed from passive to active, and the quality of good discovery, active thinking, and independent investigation is formed in the process of learning [6]. The book Perspectives on Contextual Learning established the status of contextual teaching in the western educational community, which shows a wealth of research cases in the classroom contextual learning and evaluation of learning effects [7]. Since entering the 21st century, the new curriculum reform has gradually emerged, and at the same time, the application of contextual teaching in the classroom has gradually increased, and more and more experts, scholars, and front-line teachers have recognized the importance of teaching context [8].

TEACHING CHEMISTRY IN SECONDARY SCHOOLS BASED ON AUTHENTIC PROBLEM SITUATIONS

Teaching context is in the educational teaching activities, students under the guidance of the teacher actively interact with the teaching content, means and the educational environment and other elements, so that their internal cognition, emotion and behaviour with the external teaching scene appropriate psychological atmosphere [9]. However, the author believes that the teaching context is more than a psychological atmosphere, more like an educational environment, after all, the state of mind originates from the environment. Students through independent exploration or group discussion, around the teacher's questions to collect information, find problems, analyse the problem, explore the problem, in the process to achieve the cultivation of students' problem-solving ability and innovation ability of the teaching mode [10]. This teaching mode is in line with the general idea of scientific inquiry: (create a situation) to raise the problem → conjecture and hypothesis → formulate a plan, design an experiment → obtain experimental evidence → test and evaluation → communication reasoning and summary. Therefore, this mode can to some extent awaken students' problem consciousness, enhance their motivation, cultivate their scientific thinking and practical skills, and then better achieve the teaching objectives.

The advantages are as follows:

1. Arousing students' curiosity and stimulating learning interest: the most prominent feature of the teaching method of chemistry contextual teaching is that it can transform boring chemical knowledge into interesting teaching scenes in teaching, and for students, the rich chemical context can greatly arouse their curiosity and stimulate their learning interest. Interest plays a great role in promoting students in secondary school. Good interest in learning can stimulate the unlimited potential of students, teachers consciously stimulate the interest of students can be a good guide for students to participate in the classroom, encouraging students to be brave to express themselves, in the problem solving continue to think, and cultivate learning ability. Moreover, students learn fresh knowledge through continuous exploration and research, which makes the learning state full and the learning process easier. Secondary school is a key period for students to establish a correct outlook on life, values and worldview, if students can cultivate a good interest in early, students and even the entire learning career has a far-reaching impact, not only the chemistry programme, the learning of knowledge of other subjects have similarities and differences. Because under the influence of their good interest in learning, they have formed their own learning habits and learning methods, which will be very conducive to the students' learning growth in the future [11].

2. Stimulating problem awareness and developing literacy and competence: driven by an interest in learning, students learn to think actively and to call up in their minds the content of what they have learned that is relevant to the content of the situation. Once this thinking process is switched on, the context begins to stimulate the cognitive structures in the students' minds. Driven by the contextual stimulus, students gradually perceive the obstacles that exist in the process of moving from the starting state to the desired goal state, i.e., questioning. The "question" is generated in the "doubt", "question" is the "doubt" specific expression, and finally the students mind Step by step, the formation of the problem. Problem awareness is stimulated in this process, but classroom teaching is not only to enable students to perceive the problem and ask questions, but to be able to further solve the problem, which is also known as "problem-solving learning". When the whole problem-solving learning is completed, the teaching process is complete, and the students' literacy and competence are enhanced in the whole systematic learning process [12].
3. Cultivate students' ability to actively construct cognitive structure and chemistry learning: Teachers create situations based on real problems, so that students can independently construct knowledge in problematic situations, organically combine existing knowledge with new knowledge, and independently understand knowledge so as to solve problems. And then take the initiative to complete the construction of the new knowledge system. Through the process of teacher-student, student-student and student-media interaction, students constantly adjust and improve their cognitive structure and scientific quality, and ultimately enable students to form their own unique learning ability [13].

APPLIED PRINCIPLES OF CHEMISTRY TEACHING BASED ON AUTHENTIC PROBLEM SITUATIONS

According to the characteristics of the chemistry curriculum, we can divide the problem situation into four categories in classroom teaching: problem scenarios in new lectures; problem scenarios in revision classes; problem scenarios in exercise classes; problem scenarios in laboratory classes. Different types of classroom teaching, problem scenarios appear in the timing, the form of the effect achieved is different. Problem scenarios can be a small link, can also be a main line, throughout the classroom; can be a fact, event, can also be a topic or task. Teachers can constructivist learning theory as a guide, combined with the actual social production, life, scientific and technological development and other resources, in different parts of the teaching and learning to create different forms of problem situations, the arrangement of the teaching content into a specific problem. Thus, the problem as a "stimulus" starting point, so that students are placed in a specific teaching situation, to create a questioning, inquiry, discussion, harmonious interaction of the learning atmosphere, to promote the smooth progress of teaching activities and the achievement of teaching goals [14]. The principles of application are as follows:

1. The principle of interest. Interest is a positive, a type of emotion generated by people's intrinsic needs, which can help us to complete a task or activity better and more focused, so as to obtain the pleasure and satisfaction of achieving the purpose. For students, interest in learning may be affected by a variety of factors, such as strict teachers, home parental pressure, school factors, etc. If students have an intrinsic love for learning and want to learn, it can also inspire them to take the initiative to learn, externalize their interest into action, and thus take the initiative to learn spontaneously. It is because of

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the author's low interest in learning during his academic career that the author puts the principle of interest in the first place in order to highlight its far-reaching positive impact on students.

2. The principle of liveliness. Learning cannot be separated from life, and the world of science cannot be separated from the world of life, and we live in the world of science. The new curriculum aims to closely integrate science with daily life, so we should pay special attention to students' actual experiences and experiences when designing questions. The famous American educational psychologist, D-P-AuSube1, has a classic statement, "The only important factor affecting learning is what the student already knows, and this is to be explored and should be taught accordingly [15]." This is revealing that the learning of new knowledge is based on old knowledge, and the life experience of secondary school students contains a wealth of knowledge, as long as the teacher is flexible to use life experience as a teaching tool, then the teaching work will also be twice the result with half the effort.
3. Principles of logical systematization. The principle of logical systematization means that teachers should pay attention to the creation of problem situations with the teaching of knowledge between the principle of coherence, in line with the students' cognitive logic. Because the logical systematic knowledge is more convenient for people to absorb, teachers should be aware of the learning of knowledge should be consistent with the principle of logic, in creating the problem situation should pay attention to the reality of the connection at the same time, pay more attention to the relevance of the content of the course, as well as with the student understanding of the conformity.
4. The principle of appropriate extension. The principle of extensibility, that is, the creation of the problem situation in the completion of the teaching task on the basis of the appropriate development of students' thinking, to improve the extension of students' thinking. Students' imagination and spirit of inquiry are also extended in the extension link, in line with the requirements of scientific inquiry and innovative awareness of the core literacy training of the chemical discipline. The filler-type passive teaching is completely transformed into students' active request for learning, mastery of problem-solving knowledge and ability to actively seek learning, which can make the effect and efficiency of classroom teaching can be greatly improved [16].

A CASE STUDY OF SECONDARY SCHOOL CHEMISTRY INSTRUCTIONAL DESIGN BASED ON AUTHENTIC PROBLEM SITUATIONS

Teaching Process

Perceived Problems: Social Events Contextualized Introduction to Stimulate Learning Motivation:

[Video Demonstration] In October 2019, a tragic accident occurred at the sewage treatment station of a chemical company in Shaanxi, six staff members unfortunately drowned from the sewage pool, and after investigation, the tragedy originated from a poisoning.

[Teacher Question] What substances may be present in the sewage to cause poisoning in humans?

[Students think] Volatile toxic substances.

Design Effect: through the real chemical events in society to create a problem situation, so that students feel around the chemical events occurring all the time, stimulate students to explore the nature of the learning motivation, and guide students to correctly understand these toxic substances.

Asking Questions: Setting Up Questions and Thinking Out Loud:

[Teacher] Can higher efficacy be achieved if multiple oxidizing agents are mixed and used at the same time? For example, for water purification treatment, what will happen if hydrogen peroxide and other strong oxidizing agents - potassium pertechnetate - are added to sewage?

Design effect: to further raise the question, the similar knowledge collision combination, cause students to reflect, so as to deepen students' memory, so that students form a sense of reflection, to expand students' thinking, to avoid students learning one-sided.

Sublimation of The Issue: Understanding the Current Situation of Global Drinking Water and Fostering the Concept of Ecological Civilization:

[Teacher] Multimedia display of pictures: about 1 billion people in developing countries drink unclean water, about 25 million people die every year from unclean drinking water, only 5 out of 55 rivers in Europe have barely usable water quality [17]. With the status of global water resources being this dire, what should we as students do in our daily lives?

[Students] We should pay attention to cherish and save water in our life and not pollute and waste water.

Design Effect: Through the situation of the world's water resources problems create a problem situation, let the students experience the current situation of water pollution, perceive the precious and hard-won water resources, and improve the students' scientific spirit and social responsibility of the chemical discipline literacy.

Teaching Effectiveness and Reflection

Take the redox reaction topic review as an example, from the stimulation of problem consciousness, put forward the problem, solve the problem, explore the specific use of the real problem situation teaching, from the actual life experience and cognitive level of students, select students easy to understand and accept the real problem, the real problems in life implanted in the chemistry classroom teaching, through the chemical experiments, the social hotspot events, the phenomenon of natural life, the chemical industry production and the history of chemistry. Through chemistry experiments, hot social events, natural life phenomena, chemical production and history of chemistry and other real problems of the situation of the use of good materials, so that students learn to build a more reliable subject, so as to achieve the expected purpose of teaching. This series of problem setting, from easy to difficult, from shallow to deep, students in the teacher's guidance gradually solve the problem, in-depth understanding of the application of chemical knowledge in life, better appreciate the value of chemical knowledge, feel the beauty of chemical learning, so as to cultivate students' interest in learning, to enhance their own analysis of the problem, problem-solving ability, in line with the chemical subject literacy.

However, real problem situations sometimes involve information that is not very relevant to the teaching topic, which can interfere with the students' direction of enquiry. Therefore, teachers should endeavour to make complex knowledge easy to understand, so as to help

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students better understand and master knowledge, and to enable students to grasp the key points of the curriculum more clearly, so that they can better explore and think. The case study is poor in the lack of timely training exercises, exercises also play an important role in the chemistry teaching process, the creation of real problems in the context of the exercises, you can better control the students' learning progress, teachers can reflect on the shortcomings of the teaching design based on the feedback of the students' learning results. Therefore, teachers need to intentionally interspersed in the classroom practice problems, and actively explore the integration of teaching practice and effect, at the end of the course at the same time timely test the learning effect of students, combined with the effect of feedback to enhance students' understanding and mastery of knowledge, improve the quality of teaching.

CONCLUSIONS AND OUTLOOK

Chemistry and production and life are closely linked, many events and phenomena in life will trigger students to think about the nature of this phenomenon. In chemistry laboratory teaching, more use of life elements to build a real problem situation, is conducive to breaking the barrier between student learning and curriculum teaching, so that students are attracted by the elements of the situation, in the experimental operation as far as possible to restore the real process of chemical investigation, so as to cultivate the students' independent thinking and the ability to operate. Students learning in a real problem situation will have a stronger interest in the unknown, and this process is also very conducive to the development of students' independent thinking. Authentic problem situations can inspire students to use chemical knowledge in their lives. When chemistry teachers introduce real-life problems, they can make students understand the application of chemical knowledge in various fields of life while patiently exploring the results of experiments [18]. In the process of patiently exploring new knowledge, students' awareness of society, of chemistry in life, and of the scientific use of chemical knowledge can be formed and developed. In conclusion, both chemistry teachers who are already in the profession and those who are about to enter the teaching profession in the future should be aware of the trend of the increasing importance of problem context in the design of secondary school chemistry teaching, which is of great significance for the stimulation of students' interest in learning, and the optimization of the learning process and outcomes. Therefore, teachers should integrate existing resources in daily education and teaching, and actively invoke more novel and diversified strategies and methods to build a vivid and efficient chemistry classroom [19]. When students are attracted by these rich and innovative extracurricular resources, they will be fully engaged in teaching activities, which will help the efficient completion of teaching.

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