

Research on Strategies for Cultivating Innovation Literacy in High School Chemistry Experiment Teaching

Xinling Yang

College of Chemistry and Molecular Sciences, Henan University, Kaifeng, Henan, China

Abstract: In today's world, innovation ability is an important driving factor for social development and the source of power for the progress of the entire human intelligent civilization. The three elements of innovation literacy were discussed, including innovative personality, innovative thinking ability, and innovative practice ability. This paper discusses the strategies for cultivating students' innovative literacy in high school chemistry experiment teaching.

Keywords: Experimental Teaching; Innovation Literacy; Chemical Experiments.

1. Introduction

In today's world, innovation ability is an important driving factor for social development and the source of power for the progress of the entire human intelligent civilization. The cultivation of innovative talents plays a key role in the prosperity of the country. In recent years, research on innovation literacy has become a hot research content in the education sector, and how to improve students' innovation literacy level is the key to discussing the cultivation path of innovation literacy. Chemical experiments are an important carrier for the cultivation of students' innovative literacy. Therefore, it is of far-reaching significance to explore how to use high school chemistry experiments to develop students' innovation literacy [1,2].

Chemical experiment is a research method, according to the determined research direction and purpose, researchers use relevant experimental devices, instruments and drugs, under certain environmental conditions, through certain operational means (such as heating, etc.) to observe the phenomenon of the studied substance, understand the physical and chemical properties of the substance itself [3]. Chemistry experiment teaching is to achieve the corresponding teaching purpose, appropriately select and combine the relevant content of chemical experiments, and design a complete chemistry experiment teaching system according to relevant education and teaching theories.

Innovation literacy consists of two important basic elements, one is creativity and the other is innovation. American psychologist Professor Torrance explained creativity as: the ability to sensitively observe or detect problems, combine the use of various effective information, so as to reason and analyze the solution to the problem, make reasonable assumptions, test and communicate the results. Innovation occurs in the process of socialization in which individuals constantly change old ideas and receive new knowledge in order to adapt to social changes [4,5].

2. The Three Elements of Innovation Literacy

Combined with the connotation of Chinese students' development of core competencies, this study believes that innovation literacy should include two major elements: innovative character and innovative ability, and the elements

of innovative ability include two dimensions: innovative thinking ability and innovative practical ability.

2.1. Innovative Personality

The first expert to publish and apply the concept of innovative personality to psychology was Guilford, who believed that innovative personality is a special, stable personality type that human beings exhibit when they perform creative activities. Chinese scholar Lin Chongde believes that innovative personality is a non-intellectual category of creativity. American psychologist Pfister has found that innovative personality has the following characteristics: Willingness to accept new things, independent self-confidence, like to be alone. Innovative personality is influenced by inner emotions and willpower factors; A person with an innovative personality is usually tolerant and curious about new things and ideas, has a strong internal drive to express self-assertions, has confidence in self-innovation ability, and has a personality and resilience that persists in challenges and is good at self-adjustment. An innovative personality should contain three characteristics: curiosity, willpower and assertiveness.

2.2. Innovative Thinking Ability

Innovative thinking ability is the ability to think from the methods and perspectives that break the norm, generate unprecedented, unique new ideas or produce valuable thinking results, and people with innovative thinking ability can think through association, deductive reasoning, and create more new possibilities. Innovative thinking skills focus on the process and method of thinking. Innovative thinking ability can be subdivided into three dimensions: divergent thinking ability, convergent thinking ability and recombinant thinking ability.

Innovative thinking skills focus on the process and method of thinking. Innovative thinking ability can be subdivided into three dimensions: divergent thinking ability, convergent thinking ability and recombinant thinking ability.

2.3. Innovative Practical Ability

The ability to innovate and practice is the ability to put into action new ideas created by creative thinking. Different from innovative personality and innovative thinking ability, innovative practice ability focuses more on the specific explicit practice operation of individuals. The achievement of

the goal of innovation literacy education is inseparable from this important starting point of innovative practice. This study believes that the ability of innovative practice can be further subdivided into three sub-dimensions: planning and design ability, hands-on operation ability, and cooperation and coordination ability. Innovative personality, innovative thinking ability, innovative practice ability composed of three elements of innovation literacy plank, similar to the barrel effect, the higher the height of each board, the higher the level of innovation literacy formed by the three, they are interrelated and mutually restricted, innovative character is the internal foundation of innovation ability, innovation ability is the superstructure of innovative character. In education, the ability to innovate is often closely linked to the problem-solving process.

3. Implementation Strategy

3.1. Overall Strategy: Transform Concepts and Internalize Motivation

Influenced by traditional concepts, although many school leaders, teachers and parents are willing to admit that experiments are very important and conducive to the improvement of students' innovation literacy, the most important thing in the current environment is the college entrance examination results. First of all, we should try our best to change this idea of success or failure of the theory of fractions, so that we can actively implement the fundamental goal of cultivating virtue and cultivating people. First, for teachers, they should actively organize and participate in various types of training, not only from the ideological profound transformation of concepts, but also from the aspect of professional level, hold exchange meetings or competitions, so that teachers from all over the world can gather together to carry out experimental improvement or innovation, innovative literacy implementation strategy discussion, case analysis, etc., brainstorming and common progress. Second, for students, students should deeply understand the importance of chemical experiments, such as exercising their do-it-yourself ability, cultivating scientific thinking, and so on. Regular experimental assessments or competitions for students are held by the superior department, which can not only improve the status of chemical experiments in the minds of students, but also improve students' achievements, and cultivate students' innovation literacy. Third, for experimental resources, relevant superior departments and schools should change their concepts and attach importance to chemical experiments [6]. Equip schools with a sufficient number of professional chemical experimenters, regularly update instruments and drugs under the guidance of professionals, and formulate and implement assessment standards specifically for experimenters, teachers and students.

3.2. Classroom Practice Strategies

3.2.1. Create Real Teaching Situations to Infiltrate the Cultivation of Students' Innovative Personalities

In the course introduction part, the key is to create real situations to stimulate doubts and introduce rich and effective problem situations, use the rich educational and teaching content hidden behind real problem materials, connect social production and life, and use life situation import, magic fun import, video guidance and other methods to stimulate students' curiosity, trigger students' will to insist on inquiry, and let students enter the classroom with curiosity and the

desire to solve problems urgently. In this process, we should not blindly pursue the interest of the problem and ignore the enlightening teaching value behind the problem. Before the implementation of teaching, teachers should carefully collect, mine and sort out materials related to chemical disciplines, such as news reports, interesting life phenomena, social problems, etc., and establish a database of situational materials for chemical problems.

3.2.2. Pay Attention to the Penetration of Students'

Thinking Process and the Cultivation of Innovative Thinking Ability

Innovative thinking includes divergent thinking, convergent thinking and recombinant thinking three different dimensions, in the chemical experimental exploration, teachers inspire students to think deeply, encourage and guide students to communicate and analyze the collected data, synthesize the opinions of team members, and conceive a variety of chemical experimental solutions to solve problems, so that students' thinking can be further exercised.

Therefore, in the teaching process, teachers should pay close attention to the exercise process of students' innovative thinking, guide students to brainstorm, encourage students to divergent thinking in different directions, seek chemical experimental solutions to solve problems from multiple angles, repeatedly ask themselves, think combined, combine existing ideas to solve problems, generate newer and better experimental designs, so as to inspire innovative thinking, internalize innovation literacy, and reasonably communicate and compare, abstract, generalize, etc., and improve and optimize experimental design schemes step by step.

3.2.3. Pay Attention to the Cultivation of Innovative Practice Ability through the Penetration of Experimental Inquiry Process

Experimental inquiry is carried out in the form of group cooperation, in which teachers play an important role in organizing and guiding, teachers guide students to draw theoretical ideas and model designs, organize students to improve experiments or redesign experimental devices, constantly optimize experimental design, and group cooperation to complete the construction of optimized experimental devices and experimental exploration process.

In this process, teachers should carry out appropriate monitoring and guidance for the classroom, use appropriate and inspiring language, guide and master the correct method to observe experimental phenomena and correct processing of experimental data, effectively regulate the rhythm of the classroom, improve the efficiency of exploration experiments, and make timely error correction and supplement when students carry out wrong operations and encounter difficulties to ensure the scientific nature of knowledge. When students are cooperative, communicating and discussing within the group, teachers should learn to observe and retreat appropriately, throw the priority of solving problems to students, and timely feedback and optimization of existing problems and areas for improvement in the experimental classroom.

3.2.4. Pay Attention to the Infiltration of the Evaluation Reflection Process and the Improvement of Students' Innovative Personality

Evaluation is the key link to improve students' innovative personality, and effective and diverse evaluation can create a positive learning atmosphere and improve the effectiveness of teaching. In the evaluation process, teachers guide students

to objectively analyze the results of success and failure of experiments, make reasonable attributions, and encourage group members to evaluate experiments and express experimental results. Task solving, student evaluation, teacher evaluation, etc. are the basic ways to effectively carry out evaluation activities, pay attention to the process evaluation of students' learning effects, infiltrate evaluation into the whole of teaching activities, and let students personally participate in the evaluation process, evaluate and reflect on experiments from multiple angles, and pay attention to the process of students' thinking development in the evaluation process.

Teachers can encourage and guide students to persist in the exploration of problems with appropriate language, cultivate students' willpower to persevere in experimental inquiry, and encourage students to express their opinions confidently and fluently when displaying and reporting experimental results, so as to cultivate students' innovative personality. Reasonable evaluation is to discover the direction that needs to be explored further, so teachers can introduce self-evaluation, intra-group peer evaluation and other methods into the evaluation of students according to the actual situation, and conduct comprehensive evaluation from multiple angles.

4. Conclusion

In today's global integration, the development of science and technology needs the support of creativity as a cornerstone. Since the beginning of the new century, the development of a country's economy has become more and more dependent on technological innovation and application.

The cultivation of creative talents of a nation has become the main help affecting the comprehensive national strength of the country, and in order to achieve the development goal of building an innovative country, it is necessary to improve students' innovation literacy and explore new ways of cultivating innovative talents in an important position.

References

- [1] Yanping Chen. Analysis of the role of junior high school chemistry experimental teaching on students' overall chemical literacy improvement from the perspective of innovation[J]. Examination Weekly, 2021(71):101-103.
- [2] Gongfu Huang, Hailong Zou. Preliminary thinking on the development of core literacy of scientific inquiry and innovation awareness in the teaching of chemistry experiment in middle school[J]. Chemistry Teaching and Learning, 2020 (07): 2-6.
- [3] Jianjun Huang. Exploration on cultivating students' innovation literacy in high school chemistry experimental teaching[J]. Curriculum Education Research, 2019(01):153-154.
- [4] Wenrong Zhou. Case study of chemical experimental exploration and experimental innovation literacy cultivation in junior high school: Taking "exploring the reaction of carbon dioxide and sodium hydroxide" as an example[J]. Chemistry Teaching and Learning, 2018(12):73-75.
- [5] Xiaoping Sun. Innovative experimental design to cultivate the core literacy of chemistry among high school students[J]. Curriculum Education Research, 2018(03):179-180.
- [6] Suhao Lin, Qi Zhao. Using innovative experiments to cultivate the core literacy of high school students[J]. Secondary School Chemistry Teaching Reference, 2016(23):26-29.