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Reform and Exploration of Organic Chemistry Experiment Teaching Under the Background of Curriculum Ideological and Political Education: Taking "Extraction of Caffeine from Tea" as an Example

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Abstract: Guided by the spirit of the National Conference on Ideological and Political Work in Colleges and Universities, this paper takes "Extraction of Caffeine from Tea" as an example, puts forward the necessity of carrying out curriculum ideological and political education in organic chemistry experiments, explores the approaches and practices of integrating curriculum ideological and political education into organic chemistry experiment teaching, and analyzes and reflects on the teaching effects. It provides a direction for carrying out experimental ideological and political education in other courses in the future.

Keywords: Curriculum, ideological and political education; Organic chemistry experiments; Teaching reform

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1. Introduction

It is emphasized that "The foundation of education lies in fostering virtue." As the main position and channel for ideological and political work in colleges and universities, colleges and universities should promote the same direction of various courses and ideological and political theory courses, deeply explore ideological and political elements in courses, imperceptibly integrate educational elements such as ideology, politics, morality and mental health into classroom teaching, and strive to cultivate new-era youth with ideals, abilities and responsibilities [1–3].

Organic Chemistry Experiment is a compulsory course for chemistry and biology majors at our university. Cooperating with organic chemistry theory courses, it enables students to systematically master basic operational skills of organic chemistry experiments, have the ability to correctly carry out synthesis, separation and identification of prepared products; learn to standardize the use of common instruments and equipment; improve the ability to write standardized experimental reports and consult literature, and cultivate good experimental methods and habits as well as a realistic and rigorous scientific attitude, laying a solid theoretical foundation for

subsequent course learning and future work.

2. Necessity of integrating curriculum, ideological and political education into organic chemistry experiment teaching

As a basic course for chemical engineering majors, Organic Chemistry Experiment is an important part of the organic chemistry teaching system and an independently set experimental course. The course focuses on the demonstration of basic operations and the explanation of experimental principles, and carries out systematic training around the basic knowledge, core operations, and basic skills of organic chemistry experiments, aiming to standardize students' organic chemistry experimental operation skills. The content includes the selection, installation, and disassembly of glass instruments, and the principles and operational skills of experimental technologies such as reflux, distillation, fractional distillation, steam distillation, recrystallization, extraction and suction filtration. Carrying out experimental teaching can reduce the difficulty of understanding basic organic chemistry knowledge; deepen students' memory of laboratory safety knowledge, strengthen their cognition of organic chemistry experimental methods and basic operations; and also enable them to form a rigorous and serious experimental attitude and literacy, promoting the development of students' ability to analyze and solve problems and practical operation ability.

In organic chemistry experiment teaching, students need to understand various safety knowledge. Solvents and organic reagents are widely used, which are often toxic, flammable, and explosive. For example, toxic reagents include nitrobenzene, cyanides, organic halides, organic phosphides, etc.; flammable solvents include ether, ethanol, acetone, benzene, petroleum ether, etc.; explosive drugs or gases include picric acid, hydrogen, acetylene, etc.; corrosive drugs include concentrated hydrochloric acid, caustic soda, caustic potash, bromine, etc. Improper operation can easily lead to accidents such as poisoning, fire and burns. At the same time, the instruments and raw materials of organic experiments are glass, and careless handling can lead to instrument damage and personal cuts. Therefore, in carrying out organic chemistry experiment teaching, a strong sense of safety must be established. Accidents are often caused by carelessness, improper operation procedures, unfamiliarity with instruments and drugs, etc. This requires cultivating students' safety awareness in teaching, making students concentrate, abide by operating specifications, adhere to their posts, and promote them to become talents with a craftsmanship spirit [4]. In the experimental link, students need to carefully observe experimental phenomena, process experimental data rigorously, continuously reflect, find abnormal experimental situations in a timely manner, and conduct in-depth research on the causes of the phenomena.

Experimental records are important data to support scientific research, and the quality of experimental records determines the ability to accurately analyze experimental results. Therefore, we must handle the data and phenomena generated in experiments with a scientific and rigorous attitude, especially the following contents:

(1) The amount, order and color of raw materials added.

(2) With the increase of temperature, the color change of the reaction solution, whether there are precipitation and gas.

(3) The quantity, color, melting point, boiling point, refractive index and other data of the product should be recorded in a timely and true manner.

When recording relevant phenomena, it must correspond to the experimental operation. This requires students to have certain abilities to discover, analyze and solve problems, and focus on cultivating students' sense of responsibility and mission to climb the peak of science and explore the unknown. In addition, according to the

synthesis principle of organic compounds, laboratory equipment can be used for the artificial synthesis of organic drugs to better help people maintain health. However, the use of organic chemistry knowledge to carry out illegal and criminal activities will be subject to legal sanctions. Therefore, it is very important to integrate ideological and political education into organic chemistry experiment courses, and we must focus on cultivating talents with correct values.

3. Approaches and practices of integrating curriculum, ideological and political education into organic chemistry experiment teaching

3.1. Enhancing cultural confidence and cultivating family and country feelings

Some content in experimental teaching can be introduced from historical records to stimulate students' cultural confidence. For example, in the experiment of "Extracting Caffeine from Tea", the experimental material used is tea. China has a long history of tea culture. In carrying out this experimental teaching, we can extend from tea to China's traditional tea culture and introduce Chinese history, such as the Ancient Tea Horse Road, to students. The Ancient Tea Horse Road is a witness to China's unification and a symbol of national unity. China's tea culture is extensive and profound, and tea culture is China's traditional culture. When receiving guests, drinking tea in hot weather can eliminate fatigue and bring comfort and happiness to the body and mind. In the process of planting, picking, and making tea, the noble qualities of diligence, courage, and enthusiasm of the Chinese people are worth learning from. Through learning tea culture, students can learn how to behave and carry forward the traditional virtues of diligence and self-confidence of the Chinese nation. Guide students to re-examine excellent traditional Chinese culture from the perspective of learning chemical professional knowledge, and consciously edify their minds with excellent traditional and advanced Chinese culture [5].

3.2. Integrating safety education and establishing green environmental protection awareness

As we all know, most of the reagents required for "Organic Chemistry Experiments" are volatile, flammable, explosive and other chemicals. The experimental process is characterized by the generation of polluting gases and the difficult treatment of waste liquids. Therefore, there are potential safety hazards such as explosions, fires, and burns in experiments. The teaching of "Organic Chemistry Experiments" should not only cultivate students' experimental operation skills and ability to analyze and solve problems, but also make them understand the characteristics of their major, pay attention to the relationship between disciplines and the environment, establish firm green environmental protection and safety concepts, and enhance social responsibility.

Emphasize the method of taking drugs in the experiment. For example, the volatile solvent ethanol in this experiment should be taken and used immediately. The condensed water only needs to play a condensation role to avoid waste of water resources; substances harmful to the environment and difficult to volatilize should be used and recycled, standardized to avoid environmental pollution. The above measures help students form good experimental habits and strengthen their awareness of resource conservation and environmental protection [6].

3.3. Stimulating students' learning interest and cultivating patriotic feelings

Chemical synthesis methods can carry out source synthesis or modification of natural drugs (traditional Chinese medicine), making up for the shortcomings of low yield and high toxicity in the extraction of natural drugs. The achievements we obtain through experiments are not only a substance, but also promote the transformation of

scientific thinking and lifestyle. This transformation is not only conducive to reducing the pain of patients, but also helps to improve the future life happiness index of students. Based on this, the teaching of organic chemistry experiments is no longer limited to the understanding of principles and the teaching of skills, but also extends to the spiritual field, teaching students how to transform principles into physical objects and apply them to production and life, thereby enhancing their professional pride and sense of responsibility [7,8].

From the extraction principle of like dissolves like and the selection of solvents to scientific spirit, structure determines nature and character determines destiny; Tu Youyou's use of ether extraction method to extract artemisinin is a kind of extraction, which implies that we should aim high, climb the high peak of science and technology, build a community with a shared future for mankind, and strive for a better tomorrow for mankind. From steam distillation to the acquisition of natural spices by early humans, from dibenzylideneacetone to the industrial synthesis of chemical spices, and then to the extraction of alkaloids, to the early production of caffeine in China, we introduce the history of chemical development and the history of China's chemical industry development, telling the hardships of New China's industrial and technological development. It is the spirit of self-improvement in the blood of the Chinese nation that has made the vigorous development of our national rejuvenation today, further strengthening our cultural confidence and perseverance, and cultivating students' patriotic feelings [9,10].

3.4. Strengthening integrity education and cultivating cooperative innovation awareness

After completing each experimental project, students are required to carefully write experimental reports. The recording of experimental phenomena and data and the writing of experimental reports should be realistic and fabrication is prohibited. Students should respect original experimental data, record experimental data clearly and standardizedly, and strictly prohibit plagiarism or modification of experimental data to cultivate students' sense of integrity. Although the recording of experimental data, the processing of experimental data, and the writing of experimental reports are cumbersome, they can cultivate students' carefulness and patience. In the teaching of comprehensive and designed experiments, guide students to put forward problems, explore independently, discuss and communicate in groups, and realize the multiple functions of knowledge impartment, ability training, and value guidance. Details determine success or failure. Each member of the team divides the work reasonably, cooperates closely to complete the corresponding work, and the experimental results of each member will affect the results of the entire team. In the process of group activities, each member experiences the process of discovery, questioning, exploration and gradual innovation, cultivating students' cooperative innovation spirit to discover and solve problems when facing difficulties [11,12].

4. Analysis and reflection on teaching effects

In the teaching of organic compound properties experiments, by combining experimental content, digging deep into ideological and political elements, integrating ideological and political education in the experimental process, and conducting a questionnaire survey on teaching effects through Wenjuanxing, the questionnaire investigates the ways and methods for students to learn ideological and political knowledge points in the content related to organic compound properties experiments, as well as the acceptance and satisfaction of integrating ideological and political education into chemical experiments (as shown in **Figures 1–3**).

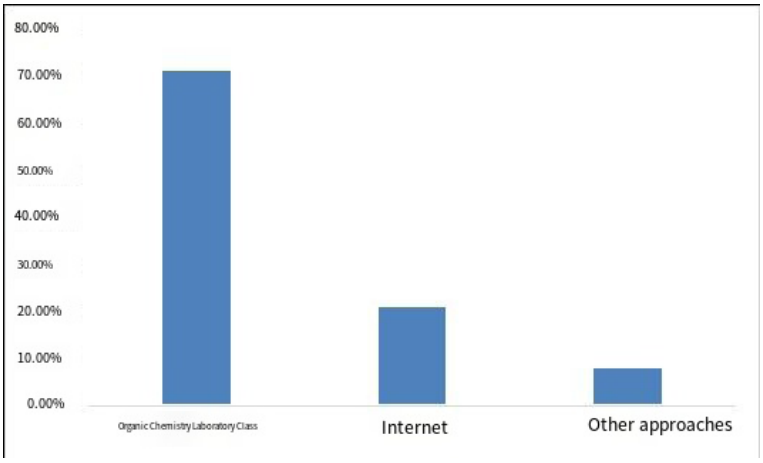

Figure 1. Survey results on the ways students obtain ideological and political education knowledge related to organic compound properties.

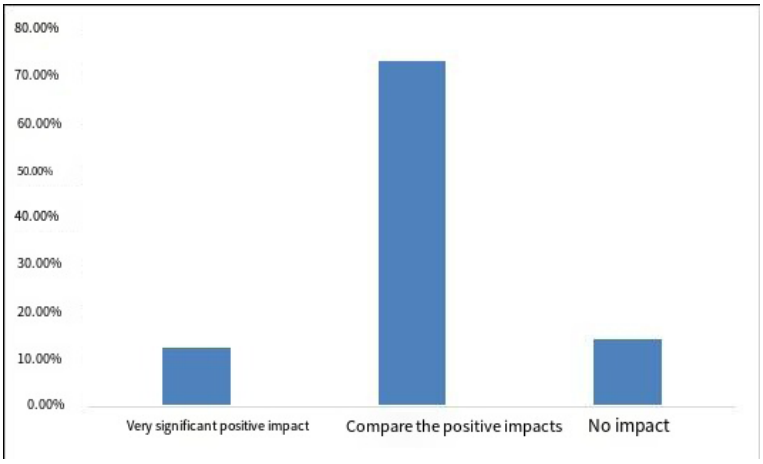

Figure 2. Survey results on the impact of integrating ideological and political education into organic chemistry experiment teaching on students' learning of organic chemistry courses.

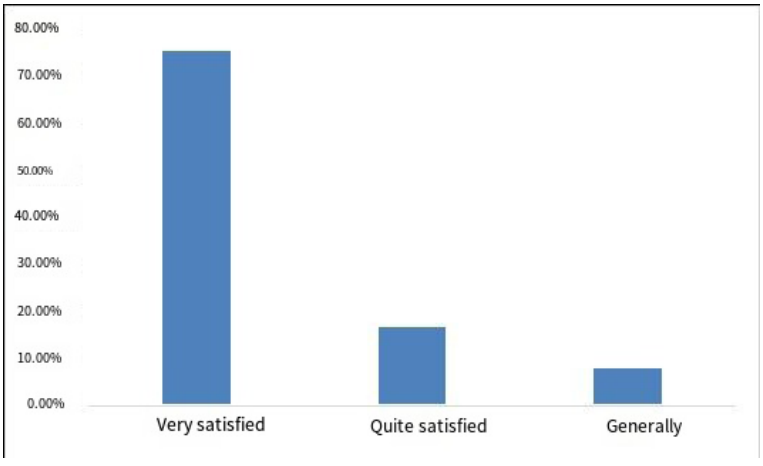

Figure 3. Survey results on students' satisfaction with integrating ideological and political education into organic chemistry experiment classes.

This survey targets students majoring in Biotechnology, Bioengineering, Applied Chemistry, and Chemical Engineering of the 2023 grade in our university, and a total of 239 questionnaires were collected. The survey results show that: regarding the ways for students to obtain ideological and political education knowledge related to organic compound properties, 71.13% come from organic chemistry experiment classes, 20.92% through the Internet, and 7.95% through other ways. The questionnaire results indicate that integrating ideological and political elements into experimental classroom teaching has a certain effect on students' ideological and political education. Students feel the charm of organic chemistry in the process of hands-on experiments, which has a certain positive impact on the formation of students' outlook on life and values. Regarding the impact of integrating ideological and political education into organic chemistry experiment teaching on students' learning of organic chemistry courses: 12.55% of the students believe it has a very significant positive impact, 73.22% believe it has a relatively significant positive impact, and only 14.23% believe it has no impact. Overall, the integration of ideological and political education into organic chemistry experiment teaching has a positive impact on students' learning of organic chemistry courses, which provides operable approaches and methods for our experimental instructors to integrate ideological and political education into future experimental classroom teaching. In the survey on students' satisfaction with integrating ideological and political education into organic chemistry experiment classes, 75.31% of the students are very satisfied with the integration of ideological and political education into organic chemistry experiment classroom teaching, 16.74% are relatively satisfied, and only 7.95% are generally satisfied. It can be seen that students recognize the teaching form of integrating ideological and political education into organic chemistry experiment classroom teaching, which provides a direction for us to carry out experimental ideological and political education in other courses in the future [13,15].

5. Conclusion

Curriculum ideological and political education is not a new course. To achieve good results in integrating ideological and political education into experimental teaching, teachers must first improve their ideological understanding and not ignore or give up because of the short class time. But at the same time, it should be remembered that experimental courses are operation-oriented courses. Unlike theoretical classrooms, ideological and political penetration cannot be carried out in many cases. We must combine experimental content to achieve an appropriate degree, not only ensuring students' hands-on operation time, but also improving students' ideological quality, realizing the goal of ideological and value guidance, achieving the purpose of fostering virtue through education, and completing the task of talent training.

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