

## Exploration of Building College Students' Innovation and Entrepreneurship Base Based on Chemical Experiment Center

Shuixian Ma

Yunnan College of Foreign Affairs and Foreign Languages, Kunming, Yunnan

**Keywords:** Chemistry experiment; College students; Innovation and entrepreneurship

**Abstract:** Innovative education is a new type of education that cultivates students' innovative spirit and innovative ability as the basic value orientation. Experiments are the most basic and reliable way to explore and discover new things, and they are the foundation of innovation. Cultivating students' serious and rigorous experimental attitudes can improve the basic quality of innovation; improving experimental interest can stimulate students' motivation for innovation; training divergent thinking can tap the source of innovation. Integrating innovative education into chemistry experiment teaching, cultivating students' innovative consciousness and innovating ability through chemistry experiment is an effective method for cultivating innovative talents in colleges and universities.

### 1. Introduction

The chemistry experiment course is very practical. The experimental course teaching corresponding to the theoretical course can not only deepen students' understanding of theoretical knowledge, but also make them correct and proficient in the principles and operational skills of the experiment, and can cultivate students' rigorous scientific attitude and ability to analyze and solve problems. Innovative education is a new type of education based on inheritance, development for the purpose of cultivating students' innovative spirit and innovative ability as the basic value orientation. Chemistry is an experiment-based science, and it is also a subject closely related to life. University chemistry experiments can not only promote the application of chemical theory knowledge, but also improve the experimenter's ability to analyze and solve problems. With the development of society, the traditional chemistry experiment teaching method can't cultivate the innovative new talents of the society. Therefore, colleges and universities should make corresponding reforms in cultivating the quality of college students (especially in terms of experimentation). The so-called experimental reform is to integrate innovative education into experimental teaching. That is to say, on the basis of retaining the essence of traditional experiments, it focuses on cultivating students' experimental attitudes, diverging students' thinking, and improving students' innovative ability.

### 2. The basic Quality of Innovation and Entrepreneurship

Experiments not only allow students to consolidate what they have learned, but more importantly, to make them better pursue scientific truth. Therefore, we must hold a serious and rigorous attitude in the process of doing experiments. However, some students only ask for speed when doing experiments. They only want to finish the experiment quickly, ignoring some important details in the experiment process. In the end, the experimental is fail or the result is not satisfied. In order to change this phenomenon, it is necessary for students to understand more about the true purpose and significance of doing experiments. It is necessary for them to understand that they must complete the experiment with a serious and rigorous attitude, and let them learn to try to adapt in this attitude in order to better achieve the goal. For example, in the caffeine extraction experiment, the sublimation operation seems to be relatively simple, but it is really necessary to make a good effort to do this step. It is impossible to find the problem without a serious and rigorous attitude. Sublimation is not only temperature-critical, but also has a certain requirement for the thickness of

the crude caffeine in the crucible: if the temperature is too high and the thickness of the crude product is thin, the caffeine is easily burnt; if the temperature is low and the caffeine is thick, the caffeine sublimation is not enough. In addition, the funnel can't be opened immediately after the heating of the crude caffeine, otherwise the caffeine will not crystallize on the filter paper but will be dispersed into the air, and the caffeine that has not been sublimed will be carbonized by air. Some students don't pay attention to these details. The result is that the crude product is burnt or the product is very small, or a little caffeine is not collected. In order to better control the sublimation conditions, some students have modified it by laying a layer of fine sand on the bottom of the crucible, then sprinkling the coarse caffeine evenly on the fine sand to make it evenly heated, and using a thermometer to insert through the funnel and filter paper into the fine sand to control the temperature. So that the crude caffeine is not easily scorched, and the crystals obtained are also increased. It can be seen that a serious, rigorous, persistent and flexible attitude is essential for doing a good job of experimentation.

The so-called attitude determines everything, the details determine success or failure, and the cultivation of students' serious and rigorous attitude is beneficial to their study and their future work.

### **3. Method of Building a Chemical Laboratory and Thinking Innovation Laboratory**

The purpose of creating a thinking innovation laboratory is to provide chemical experiments for students in materials and engineering, chemistry, and materials science through chemical experiments. The theoretical framework of thinking innovation is established from seven aspects: thermodynamics, dynamics, psychology, physiology, methodology, engineering, and success. The mathematical process is used to represent the material process of thinking, and the thinking innovation laboratory and modern instrument analysis are used to prove the material process of thinking, so as to obtain the teaching conditions combining theoretical knowledge and practice.

Domestic college students have undergone many years of exam-oriented education, and they lack a good attitude to question. The ability to innovate is also limited to a certain extent. In order to cultivate students' innovative ability, we made the following attempts. First of all, in the classroom education, innovation education is always carried out, leaving enough room for students to think in the teaching, encouraging students to take the initiative to participate, boldly asking questions, stimulating students' curiosity and divergent thinking, to cultivate students' innovative ability. Secondly, actively carry out multi-level scientific and technological innovation activities, encourage students to establish a dynamic scientific and technological team, and use a scientific professional curriculum system as a guarantee to foster and create a good atmosphere for scientific and technological innovation through exchanges and cooperation, and encourage students to participate in various innovation competitions. Finally, based on the existing conditions, students' creativity is stimulated through simple teaching examples, and students are encouraged to design experiments and practice their innovation results.

For chemistry experiments, usually design different synthetic routes for the same experimental project, using different raw materials or several different amounts, and exploring new experiments on the basis of similar or similar materials, thus overcoming the shortcomings of the traditional experimental content and the experimental requirements. Based on the Chemistry Experiment Center, after years of exploration, the Think Innovation Lab was created. Its main work is to use the invention and creation results, business plans, patent templates, etc. as teaching materials, to carry out brain sports meetings, organize academic exchanges, and scientific and experimental discussions. Students can freely put forward experimental research ideas, through the examination and approval, project establishment, experiment, academic exchange and analysis and summary, and combine the knowledge inside and outside the class to combine the chemical experiment with the innovative thinking education. In this way, we will explore a teaching method and approach to cultivate college students' innovative spirit and practical ability, in order to solve the problem of disconnection between theory and practice, out-of-class extracurricular, and disconnection between school and society.

In order to verify the theory and process mechanism of thinking innovation, a base of thinking innovation and invention creation was established. Including: literature, sample samples, patent agents, test instruments, evaluation systems, and other three ways of thinking innovation education are: 1. Open courses of thinking innovation (such as creation and development, thinking innovation psychology, etc.), and carry out high-level professional training in thinking innovation. 2. In the teaching of other cultural courses, basic courses, and professional courses, infiltrate the training content of innovative personality, creative thinking, and innovative thinking techniques. 3. Conduct social surveys, scientific and technological competitions, scientific and technological achievements exhibitions, etc., and expand the thinking and innovation results. Our thinking and innovation education is a new teaching mode. It is constantly being practiced and explored. We will continue to analyze, summarize, improve and perfect it to make it further healthy development.

#### **4. Method of Innovation and Entrepreneurship Reform in Chemical Experiment Center**

##### **4.1. The Idea of Designing Experimental Teaching Content.**

According to the "basic-integrated-application" idea, the experimental teaching content is designed, the basic skills are highlighted as professional skills services, and the comprehensive skills training is strengthened.

(1) Generally speaking, it emphasizes the basics and highlights the position and role of basic experimental operation skills in basic chemistry experiment teaching, because these skills are the necessary ability of applied talents, and also the cornerstone for students to learn professional skills in the future. The normative nature of basic operations and basic skills must be strictly emphasized in the teaching process.

(2) Increase the proportion of comprehensive experiments. The comprehensive experiment strengthens the synthesis of skills, that is, the preparation, separation, purification, determination of impurity content, physical and chemical properties and determination of material composition, such as preparation and purity analysis of ammonium ferrous sulfate. Through the training of comprehensive experiments, on the one hand, it helps students to fully understand and master the teaching content of basic chemistry experiment courses; on the other hand, it strengthens the comprehensive training of students' various basic operational skills.

(3) Open a number of design experiments. The experimental projects are closely integrated with the majors to enhance the application of skills. For example, bio- and food-related students may choose: spectrophotometric determination of iron content in tea, determination of vitamin C content in tomato, determination of acidity and calcium content of yogurt, determination of nitrite content in meat products and social survey, analysis of inorganic components of traditional Chinese medicine. The projects selected by environmental students include: research on mercury leakage in different brands of batteries, and the chemical scores of copper in the sediments of the estuary are equal. Design experiments not only cultivate students' comprehensive ability to analyze and solve problems and design innovation, but also reflect the characteristics of professional services.

##### **4.2. Integrate Teaching Content with a Series of Experiments.**

The series of experiments, that is, the previous experiment is the basis of the latter experiment. For example, the series of experiments of acid-base titration includes the following three aspects: (1) Students clean glass instruments and master the weighing technology of materials; (2) Using the weighing method to correct the glass instruments cleaned by the previous experiment, such as volumetric flasks and acid-base burettes; (3) Preparing and calibrating the acid-base solution with a calibrated glass instrument; On this basis, students use their own acid and alkali to determine the total acid content of the vinegar or the nitrogen content of the ammonium salt. Students must successfully complete each experiment, otherwise they will not be able to conduct follow-up experiments, fully mobilizing the enthusiasm and initiative of students.

### **4.3. The Combination of Compulsory Experiments and Selected Experiments.**

Emphasis on individualized teaching content, the combination of compulsory experiment and selected experiment, encourage students to complete other interesting experimental contents under the guidance of teachers according to professional characteristics and personal hobbies. In the course scores, students who actively participated in the experiment were selected to reward points, highlighting the cultivation of innovative spirit and practical ability.

### **4.4. Students-dominated and Teacher-Led Experimental Teaching Methods.**

Reforming the traditional teaching-centered experimental teaching method for basic and comprehensive experiments, when we organize experimental teaching, we advocate the student subject, the teacher-led "students direct students" experimental teaching new mode, and boldly practice the transition from "teaching" to "study" as the center, and provide conditions for cultivating students' innovative ability. The teaching mode is divided into three stages. The specific method is to arrange about 4 students per experiment. (1) The four students will review the materials before the experimental class, pre-test, discover and discuss the problems, and write the experimental report. At this stage, teachers must have a high sense of responsibility, and must guide the students' experiments throughout the course, so that students can truly achieve the experimental purpose, experimental principles, experimental instruments, experimental procedures and experimental key snacks through this stage; (2) Students prepare experiments according to pre-experimental conditions, teachers check student preparations, and improve experimental preparation; (3) Students explain the principle of experiment in the classroom, guide other students to complete the experiment, teachers organize the teaching process, and judge the students' explanation and guidance. This kind of student-participating experimental teaching method not only enhances students' interest in experiments, but also enables students to deeply understand the design ideas and experimental key of experimental content, and improve students' ability to apply knowledge.

## **5. Summary**

Experiments are an effective means to improve students' practical ability and innovative ability. In order to enable students to develop this ability better, all colleges and universities must carry out corresponding reforms on experiments, and must do a good job in formulating experimental syllabus and other basic work under the guidance of innovative ideas. This is actually to meet the requirements of the contemporary society for the quality of college students, but also to prepare students for a satisfactory job. As teachers, students should not be allowed to do experiments mechanically, so that they should always keep their own thinking agile, encounter areas where experiments are not perfect, fully divert their own thinking, try to perfect their experiments, to achieve better experiment results. In addition, teachers should pay attention to students' sense of innovation, inspire students' innovative ideas, stimulate students' interest in innovation, cultivate students' innovative ability, and improve students' ability to analyze and solve problems in the process of practice. This is not only beneficial to improve students' ability to innovate, but also helps students to improve their ability to deal with practical problems. It will be of great help to students' future study, work and life.

## **Acknowledgements**

Scientific research fund project of Yunnan provincial department of education in 2019 (2019J0251), Exploration on the importance of chemical experiment to nursing profession.

## **References**

[1] Yan H, Hu H Y. Design and Realization of Innovation and Entrepreneurship Service Platform for Undergraduates Based on Big Data[J]. Applied Mechanics & Materials, 2013, 411-414:394-397.

- [2] Liu C H, Xiao-Hub L I, Gang L I, et al. Practice and Exploration of the Undergraduate Innovation and Entrepreneurship Training Program[J]. Research & Exploration in Laboratory, 2014.
- [3] Shi Z F, Wang A R, Jia-Ming L I, et al. Research and practice on the training system of the students' innovation and entrepreneurship ability in applied undergraduate college——A Case Study of Qinzhou University[J]. Journal of Qinzhou University, 2014.
- [4] Zhang C, Yang X, Yanlong M A. Cultivation of Innovation and Entrepreneurship Abilities of Undergraduates——Based on Comprehensive Experiments in the Major of Heat Treatment[J]. Guide of Science & Education, 2017.
- [5] Wang L, Yang-Liang L I, Liu L W, et al. The Exploration of the Innovation and Entrepreneurship Cultivation of Undergraduates Based on Subject Competition[J]. Education Teaching Forum, 2017.
- [6] Zhao G, Liu C, Zhang C, et al. On the Cultivation of Innovation and Entrepreneurship Ability of Undergraduates under the Productionstudy-research Cooperation Education——Based on the Practice of College of Life Science at Jilin University[J]. Vocational & Technical Education, 2015.
- [7] Guo T, Office T D, University X. Exploring and Constructing a New Educational Mode of Undergraduates Innovation and Entrepreneurship with a System of “Five Elements Driving One Cycle”[J]. Research & Exploration in Laboratory, 2016.
- [8] Peng Y. Exploration of Animal Physiology Teaching Reform Based on Cultivating the Undergraduates' Innovation and Entrepreneurship Ability[J]. Anhui Agricultural Science Bulletin, 2017.
- [9] Chao W U. Exploration on the Strategies of Undergraduate Innovation and Entrepreneurship Education in Current Stage[J]. Journal of Fuqing Branch of Fujian Normal University, 2017.
- [10] Peng X F, Ling-Jie L I, Management S O. Discussion on the Innovation Mode of Undergraduates Innovation and Entrepreneurship Incubation Base Based on Internet[J]. Sci-tech Innovation and Productivity, 2018.
- [11] Birx D. Building an Integrative Undergraduate Education: from Exploration and Discovery to Innovation and Entrepreneurship[C]// APS March Meeting. American Physical Society, 2018.
- [12] Tan J Y, Division A A, University T N. Practice and exploration of the funds management in the undergraduate innovation and entrepreneurship training program[J]. Laboratory Science, 2017.
- [13] An-Ping D U. Literature Retrieval Instruction Model Based on Undergraduate Training for Innovation and Entrepreneurship[J]. Library Research, 2016.
- [14] Zeng X, Qiaoyun L I, Renzhong F U, et al. Exploration and Practice of Constructing College Students' Science and Technology Innovation Team[J]. Experiment Science & Technology, 2018.