

**The reform and construction of experimental teaching for ‘Computer aided design of material structure and performance’ under the cultivation model of innovative talents ——the example of Guizhou Minzu university**

Weifu Cen<sup>1,4, a</sup>, Lin Lv<sup>2,4, b</sup>, Yinye Yang<sup>3,4, c</sup>

<sup>1</sup>Guidance center of Innovation and Entrepreneurship, Guizhou Minzu University, Guiyang, 550025, China

<sup>2</sup>The engineering technique training center, Guizhou Minzu University, Guiyang, 550025, China

<sup>3</sup>The college of materials science and engineering, Guizhou Minzu University, Guiyang, 550025, China

<sup>4</sup>Special and key Laboratory of Guizhou Provincial Higher Education for Photoelectric information processing and analysis, Guizhou Minzu University, Guiyang, 550025, China

<sup>a</sup>ceweifu1988@sina.cn, <sup>b</sup>926026261@qq.com, <sup>c</sup>1142702024qq.com

---

*Abstract: Under the constructed background of “double top discipline” and “innovation and entrepreneurship”, the professional training target, the training plan and the corresponding teaching need to reform. The experimental teaching must reform which is an important part of course system and course content, and it plays an increasingly important part in the cultivation of practical and creative ability for students, specifically. In this paper, we take the course of ‘The computer aided design of material structure and performance’ as a typical case, analyzing the present situation of experimental course system, and analyzing the existing problems of experimental teaching. The construction and reform of curriculum system are surrounding the training target of materials professional student, and the theory teaching system is contact the experiment course system and content, this result is providing reference for the teaching reform and implementation of experimental course of materials.*

*Keywords: Experimental teaching, Teaching reform, Talent cultivation, Teaching system.*

---

## 1. INTRODUCTION

Experimental teaching is the method and approach of the innovative awareness and the innovative ability training for student, and it becomes a focus of attention in the 13th five-year plan period [1]. The teaching plan of improve the training proportion of innovative, complex, applied and skilled personnel were write in the official documents of Outline of the 13th five-year plan for national economic and social development of the People's Republic of China [2]. So, the reform of education is deepening, the innovations include reforming curriculum setting, teaching content, assessment method and so on, these are keep pace with the times, especially the experiment education and practical teaching [3]. The material science and engineering is a new course to our school and it was course setting in 2012 [4]. After five years of exploration, the basic experimental teaching curriculum system has already established, but the experiment outline, and experiment project are break away from the training objective, at the present stage. So, the experimental teaching curriculum system must reform and innovated, is to cultivate creative talents better.

The experimental of Computer aided design of material structure and performance is the important laboratory course for the specialized of the material science and engineering, the composite material, the materials chemistry and so on [5]. This course is a design experiment courses which is based on the specialized knowledge of material science, physical and chemistry [6]. It integrates the practice, application and innovation of practice, so the students should be provided with the knowledge of material science, physical and chemistry [7]. The aim of this experiment course is to improve student's ability innovated, in particular, the design experiment is of great significance to cultivate students' comprehensive quality, is play an irreplaceable role in the aspects of the innovative consciousness, the innovative ability and the practical ability [8]. At present situation, in order to improve the employment competitiveness of the student which the major is material science and engineering, the experiment course should be reform and the curriculum system needs to be establish [9]. Combine the professional features of material science and teaching resources, the author put forward the experimental teaching reform of the computer aided design of material structure and performance. That is to say the basic experimental skills training, the thinking ability training and the thinking innovation training are scheduled in the self-designed experiment, and during the course of the experiment this course regards the content standards, emphasis the process discipline [10]. The course system is forming the opening procedure, a topic, design content, organizational management and evaluation mode of the experiment [11]. We utilize school resources rationally, stimulate the motivation of learning and improve the level of interest and consciousness, develop students' ability to complete, communicate, summarize and report writing.

## 2. STATUE OF EXPERIMENTAL COURSE

There are mainly problems in the teaching of materials of our university. Firstly, in the terms of experiment content, the experiment content are mainly the physical and chemistry, the other

status are these that the content is scattered, the experiment form is single, the experiment system is not perfect and the laboratory is short [12]. The experimental teaching pattern continue to use the physical chemistry experiment teaching mode, the experiment content are mainly the replication experiment, there are fewer comprehensive experiments, there are not open the design experiments. Secondly, in the terms of experimental preparation process, in order to ensure the normal operation of the experimental teaching, the experimental technicians in each group were adjusted before class. Thirdly, in the terms of experiment teaching process, they are experiment class by taking class as a unit, the experiment was carried out in groups, the students is divided into pairs of two. The experiment instructs teacher to explain the experiment purpose, the experimental principle, the experiment procedure, the use of the experimental equipment, the attention matters and so on, and completes the whole demonstration of the experiment operation. Fourthly, in the terms of experiment teaching effect, the students are completed the experiment content during the stipulated period of time, the experiment data are basically the same, but this teaching killing the students' creative thinking training, reduce the students' practical ability and innovation ability. This result of this kind of experimental course is that the students mechanically completed the experimental practice, which did not achieve the practical ability, thinking ability, experimental ability and innovation ability of the students. It leads to students' interest in experiment, experiment importance, initiative, ability, knowledge and skills, the ability to achieve mastery through a comprehensive, integrated application ability of various kinds of experimental methods and techniques.

### **3. THE SUBSISTENT PROBLEMS IN CLASSICAL COURSES SYSTEM**

Firstly, in terms of thought, the material science and engineering is a newly subject for Guizhou Minzu University, the source of students main come from the other professional using regulate. The students are not identified the professional, the important of the experimental course is not brought to the forefront for student, the important of the experimental teaching is not realize for the student in the comprehensive ability training, the student are lock of the comprehensive understanding of engineering teaching system. The experimental course is considered as an assistant to the theoretical curriculum, the experimental is far from practical, the actual work and the development of oneself are not very helpful, and it just as a course indicator of credit certification, in their mind.

Secondly, in terms of initiative, the student got no initiative in the experimental course, many students adopt a coping attitude on the experimental course, and they are not preview the experimental. They are no preparation in the experimental objective, the experimental principle, the experimental procedure, the instrument operation and other aspects. The student showed the poorly experimental skills, fear emotion and lock of interest in experiment. However, the occurrence of such phenomena cannot be attributed to the students themselves, and some extent, they are related to the curriculum development of the school and the development of the subject.

Thirdly, in terms of experimental class hours, due to the increase of ideological and political courses, the public courses and the professional theory courses, the experimental course was marginalized.

Fourthly, in terms of teaching staff, our school is a major in the history of literature, the subject of science and engineering is developed in recent years. There are few full-time experimental teachers, most of which are prepared by experimental technicians and the experimental guided by professors of theory course. However, the theoretical teaching task are becoming more and more onerous, in addition, the scientific achievements are consume the mainly vigor. This leads to the lack of experience in teaching reform and participation in laboratory management and construction. So, the work of experimental teaching reform is mainly conducted by the subject director instructing and the experimental technician, which has caused the disconnection between the theoretical teacher and the experimental research.

Fifthly, in terms of teaching expenditure, the lack of experimental teaching funding makes the teaching experiment equipment upgrade show, the part of experimental equipment aging, insufficient experiment on, even in the absence of instruments and equipment cannot leave, lead to limited experimental content updates. In order to ensure the smooth completion of the experimental teaching tasks, the experimental technicians spent time on the maintenance of old equipment, so that many experimental reform ideas could not be realized due to backward equipment.

#### **4. THE REFORM AND CONSTRUCTION OF EXPERIMENTAL COURSE SYSTEM**

Currently, there is on the experimental course 'Computer aided design of material structure and performance' in Guizhou Minzu University, the curriculum system, the teaching methods and the assessment methods of the experimental are almost blank [13]. Given the original experience of experiment courses and the existing shortcomings, in order to avoid this situation, appear again in the new experiment courses, establish conforms to the modern material science and engineering professionals to develop the experimental teaching of the course system is necessary. Based on the actual situation of our school, the author puts forward the construction ideas and methods of the following experimental course system. The course 'Computer aided design of material structure and performance' is independent from the course of physics, chemistry, the material preparation, and the material testing, based on the advantage of the computer technology, combining the computer technology with material structure and performance testing, establishing a virtual material structure and performance laboratory. The experimental curriculum system of "basic theory - experimental skills - innovation design" is constructed, form the experimental teaching of "professional basic - experimental skills - integrated design". That can make the students through the training of the comprehensive experiment, in terms of the selected topic, the literature, the experimental design, the system installation. The exercise can enhance students' practical ability, thinking ability, broaden the students' knowledge. At the same time, the students master the scientific experimental methods and skills, training students' comprehensive use knowledge analysis and problem-solving skills,

the cultivation of innovative thinking ability and innovative thinking and lay a foundation for the further study.

#### 4.1. The reform and construction of experimental course system

Currently, there is on the experimental course 'Computer aided design of material structure and performance' in Guizhou Minzu University, the curriculum system, the teaching methods and the assessment methods of the experimental are almost blank. Given the original experience of experiment courses and the existing shortcomings, in order to avoid this situation, appear again in the new experiment courses, establish conforms to the modern material science and engineering professionals to develop the experimental teaching of the course system is necessary. Based on the actual situation of our school, the author puts forward the construction ideas and methods of the following experimental course system. The course 'Computer aided design of material structure and performance' is independent from the course of physics, chemistry, the material preparation, and the material testing, based on the advantage of the computer technology, combining the computer technology with material structure and performance testing, establishing a virtual material structure and performance laboratory [14]. The experimental curriculum system of "basic theory - experimental skills - innovation design" is constructed, form the experimental teaching of "professional basic - experimental skills - integrated design". That can make the students through the training of the comprehensive experiment, in terms of the selected topic, the literature, the experimental design, the system installation. The exercise can enhance students' practical ability, thinking ability, broaden the students' knowledge. At the same time, the students master the scientific experimental methods and skills, training students' comprehensive use knowledge analysis and problem-solving skills, the cultivation of innovative thinking ability and innovative thinking and lay a foundation for the further study.

Table 1. the type experiment accounts for the proportion of the experiment

The type	design	comprehensive	innovative
The proportion (%)	50	30	20

#### 4.2. The experiment form and the experiment time

The experiment form is divided into two parts, which one is collective teaching, the other is scattered teaching. The collective teaching is take the class as the unit and teaching in the computer lab, competing the basis simulation software teaching and the basis material structure modeling teaching. The scattered teaching is that the student is independent experiment, the student independent study, and compering the design, the synthesis experiment and the innovation experiment of material structure and performance.

The experimental period is chosen by the students themselves which is not time limit by laboratory open time, and the experimental results must be completed within the time required.

This strategy not only can deepen student's understanding of experimental courses but also can use the common simulation software for the basis of student engineering practice. At the same time, establish a perfect open experimental management system include the experimental data, the internet video guidance, the award-winning work display, the new research results in related fields, the interactive communication section.

### **4.3. The evaluation and evaluation of experimental results**

In order to fully achieve the education target of the experiment course of the material structure and performance design of computer aided, and initiative the subjective subject of student, promote the students' innovative ability gradually form, establish a scientific and reasonable appraisal system more conducive to the cultivation of students' innovative ability. The experimental results are evaluated by the method of design experiment, comprehensive experiment and the difficulty degree of innovative experiment. The experiment score is according to the experiment result, which is include the feasibility of the combination of experimental design, operability and scientific nature, the experimental effect link refining experiment result and so on, form a scientific system for examination and assessment of experimental results. The evaluation result is not only to focus the accuracy of the experimental results, but also to emphasize the evaluation feedback and recognize the results and improve the original status. Through the experiment course teaching want to truly reflect the students' effective grasp of the course content, but more importantly hope to reflect the students' ability of independent analysis, problem solving, and its degree of innovative thinking and ability development; On the other hand, cultivate students' innovative ability using design experiments and stimulate students' interest in experimental subjects.

## **5. CONCLUSION**

The text elaborates the important of course system and course content reform of the experimental, analyzes the role of experimental teaching in the cultivation of students' practice ability and innovation ability, analyzing the present situation of experimental course system, and analyzing the existing problems of experimental teaching. The construction and reform of curriculum system are surrounding the training target of materials professional student, and the theory teaching system is contact the experiment course system and content, this result is provided reference for the teaching reform and implementation of experimental course of materials

## **ACKNOWLEDGEMENTS**

This paper was supported by the science and technology foundation of Guizhou Province, China (NO. LH [2016]7077 and NO. LH [2015]7218), the youth science and technology talents growth fund program of GuiZhou province education department, China (NO.KY

[2016]166 ) and This research was supported by Innovation Group Major Program of Guizhou Province (No.KY[2016]029).

## REFERENCES

- [1] Gao Dongfeng, Wang Shen. The influence of virtual reality technology development on college experiment teaching reform and coping strategies [J]. China Higher Education Research, 2016 (10):56-59.
- [2] Tian Chunliang. Optimize the content system of organic experiment and cultivate students' comprehensive ability [J]. Science and Technology Innovation Herald, 2011 (31):164-164.
- [3] Zheng Bo. Innovation of China's higher education management system mechanism embracing the second-class discipline construction [J]. Beijing education (high education), 2016 (3):8-11.
- [4] He Rongxin, Huang Cheng, Peng Jindong. Innovative education in physical chemistry experiment teaching reform [J]. Journal of southwest normal university (natural science edition), 2012, 37 (4):186-189.
- [5] Chen Jianming, Yu You. The reform and innovation of cell biology experiment teaching [J]. GuangZhou Chemical Industry, 2014, 42 (3):128-129.
- [6] Xun Lixin, Chen Yuxiang, Qian Yanchun. The exploration of experimental teaching reform of biological engineering [J]. Journal of Microbiology, 2013, 40 (9):1710-1714.
- [7] Li Fanxiu, Sun Shoucheng, Deng Shiyang. A brief discussion on the reform and practice of applied chemistry experiment teaching [J]. Laboratory research and exploration, 2014, 33 (4):198-202.
- [8] Bai Guangmei, Ren Hairong, Zhao Jingqiang. Construction of an open inorganic chemistry experiment teaching system [J]. Experimental science and technology, 2015, 13 (06): 36-42.
- [9] Yang Yan, Liu Chunlin, Chen zhidong. From the reform of macromolecule experimental teaching to innovate talent cultivation [J]. Macromolecular bulletin, 2015 (11):86-92.
- [10] Xu Fengguang, Yang Fengling, Cai Shuyuan. The reform and innovation of the system and content of material specialty experiment course [J]. The exam week, 2014 (18):3-5.
- [11] Xiao Xuechun, Wang Yude. Material inorganic and analytical chemistry experiment teaching reform practice [J]. Experimental science and technology, 2016, 14 (1):153-157.
- [12] Cai Yuanqiang. A number of thoughts on the transformation and development of high level universities in China in "double class" construction -- taking zhejiang university of technology as an example [J]. China Higher Education Research, 2016 (10):33-37.
- [13] Wang Qianrong, Ren Liqing. The construction of regional innovation capacity of local universities under the perspective of "double - class" construction [J]. Chinese high education research, 2016 (10):38-42.
- [14] Wang Wei, Meng Xianggui, An Ying. Exploration of experimental teaching reform under "innovative talent training mode" [J]. Experimental science and technology, 2013, 11 (2):144-146.