

Teaching Method and Pattern Research for Open Experiment of Biotechnology

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Abstract. This thesis makes an analysis and research into the open experimental teaching for biotechnological majors in colleges and discusses the content, teaching method and pattern, specific process and final assessment and mechanism of open experiments. The content of the open experiment plays a decisive role in the experimental teaching. Three aspects are very important. They are the innovation, practicality and synthesis of the experimental content. Assessment method and mechanism includes the integrity of experimental implementation, experiment with reasonable progress, the reliability of the experimental project report and papers and rewards. It provides reference for the cultivation of innovative talents with high capacity for scientific research, as well as the establishment of open experiment for biotechnological majors and the improvement of system.

Introduction

Biotechnology is a multidisciplinary and integrated major. Experimental teaching is one of the main components of higher education teaching system. It combines theory teaching, the cultivation of students' experimental skills and practical ability. However, as traditional experimental teaching has fixed content and outdated technical methods. It has, to a great extent, been unable to solve the problems that students meet in their employment and enrollment for schools. At present, most of the experimental teachings still retain the teaching ideas in the 1980s and 1990s. There is a lack of experimental content which is in line with social needs. As a result, the experimental abilities of college students are low. They are short of innovative thinking, dogmatic and inflexible. They cannot adapt to social needs. Therefore, colleges and universities especially university education should focus on the development and needs of society, treat the improving of the students' experimental skills, the practical abilities and innovation abilities as the target, and create a new teaching system. Therefore, Open Experiment emerged in university education [1, 2].

Open Experiment is different from the fixed traditional experimental teaching; it encourages and supports the teachers to create innovative experiment based on their own teaching knowledge and teaching ability. And it focus on developing students' practical experimental skills to enable students to master novel experimental methods, thus, lay the foundation for future work and future education. Simultaneously, Open Experiment break through the boundaries of different courses corresponding experimental teaching, make full use of experimental resources and laboratory equipment, as well as cultivate students' innovate ability and team coordination. This has important implications for the reform of university teaching experiment [3, 4].

The Content of the Open Experiment

The content of the open experiment plays a decisive role in the experimental teaching. To develop specific content you should base on the characteristics of the biological systems expertise, to the use of exploratory research moderate guide to inspire learning and exploratory research as the core. Meanwhile, open experiment also need to develop a student experimental program according

to different grades, different experimental basis and expertise. Combined with research needs, disciplines and social needs instructors need to put forward a series of the experiment with the initial exploration. Give a full play to the students' imagination and foster students' autonomy. Then within the given experimental scope and based on students' own interests or social practice, students should develop experimental implementation and timeline. After instructor review the guidance completed, Open experiments' flexible way to carry out can meet the different needs of students [5, 6]. And the experimental content should be designed innovatively, practically and progressively (refer with: Table 1.).

The Innovation of the Experimental Content

To cultivate the undergraduates' research and innovative capacity is an important issue that colleges and university urgently need to solve at present. Students of biotechnological majors should have independent experiment skills even more, make full use of theoretical knowledge to the research work, and produce and create the socially valuable outcomes. The frontier science experiment techniques may propose a creative experiment program that based on own interest and ideas under the guide of instructors enables to achieve the innovative openness content. This is also the academic ability that undergraduates should have.

The Practicality of the Experimental Content

Open experiment may have thematic contents, such as biochemistry experimental projects, cell biology topics, molecular biology topics and so on. Through the thematic experiments of different special topics students can not only learn more practical and innovative knowledge, but also practical techniques and skills that are not available in their own by learning from each other. In addition, practical experiments should be envisaged in the future research needs of high-level, as it carries out the graduate experimental works and experimental work research projects, so that it has a bridging to provide practical effects.

The Synthesis of the Experimental Content

Open experiment should not be limited to traditional experimental teaching models and methods, and may absorb and learn from the advanced and successful experimental experience and content, to achieve the versatility and flexibility of the teaching. At present, our country needs more complex talents, and biotechnological majors is just the interdisciplinary advanced major. It allows the content of the students not be limited to the single direction and filed, but a comprehensive and interdisciplinary learning and mastering to cultivate the multi-faced and multi-level comprehensive research talents.

Tab.1 Open experiment reform content

Item	Direction	Specific content
Experimental Reform	Innovation	independent experiment skill; theoretical knowledge; own interest and ideas
	Practicality	practical techniques and skills; high-level research
	Synthesis	advanced and successful experimental experience; versatility and flexibility of the teaching

Open Experimental Teaching Methods and Implementation

The open experiment of biotechnological major is different from traditional experimental

teaching methods. For example, to experimental materials, not by purchasing or simple preparation, some require germination or plant growth and other animals. So, according to the direction and programs of the students' experiments, instructors should guide students to allocate time reasonably, carry out experiment and reserve time independently. The implementation process should be the direction and subject that designated by instructors, and chosen independently. Before determine the experimental project students should discuss with instructors. And instructors will examine the experimental program, conduct the experiment, supervise the progress of the laboratory and the result and discuss of the experiment, prepare a report of the experiment and finish archive [7, 8].

Before the experiment the instructors should develop correspondingly experimental requirements, and put forward specific requirements of experiment records, operation and the observation records and finishing induction of the experimental results. So that students can deeply understand and master the content of what they have learned and researched as well as the problems that exist during the open experimental teaching. Moreover, open experiment broaden their knowledge, develop their capacity of finding and solving problems and improve their interest and quality in learning.

Assessment Method and Mechanism

The assessment of the Open Experiment is the means to ensure students complete the experiment condition, as well as plays a role of overseeing and supervising the students. Traditional experimental assessment is in the forms of test report, which, of course, is difficult to find the practical problems of the students, and become the payable tool for students [9, 10]. Open experiment assessment focus more on developing the experimental innovative ability, practical ability and comprehensive ability. Therefore, comprehensive assessment methods should be used in assessments (refer with: Fig 1.).

The Integrity of Experimental Implementation

Mainly to check whether or not the student can record experiment and conduct the experiment as planned, and make the Open Experiment conduct the experiment in is entirely.

Experiment with Reasonable Progress

Mainly to check students' preparation before carrying out preliminary experiments and the mastery of experimental progress during the experiment, and whether they can make reasonable arrangements with time and staff to achieve high efficiency.

The Reliability of the Experimental Project Report

Mainly depends on the specifications of the students' lab report and the reliability of the students' experimental results, to identify the problems, and solve the problems we identified, able to learn lessons and summarize experiences.

Papers and Rewards

After the completion of the pilot project, whether or not students have published the papers or worked participation award and other outcomes to achieve the transformation of the experimental outcomes. And these aspects of the assessment are the evaluation of the experimental program, the experimental process and the experimental conclusion. Moreover, it is better able to consider the comprehensive and fair evaluation of the students' achievement.

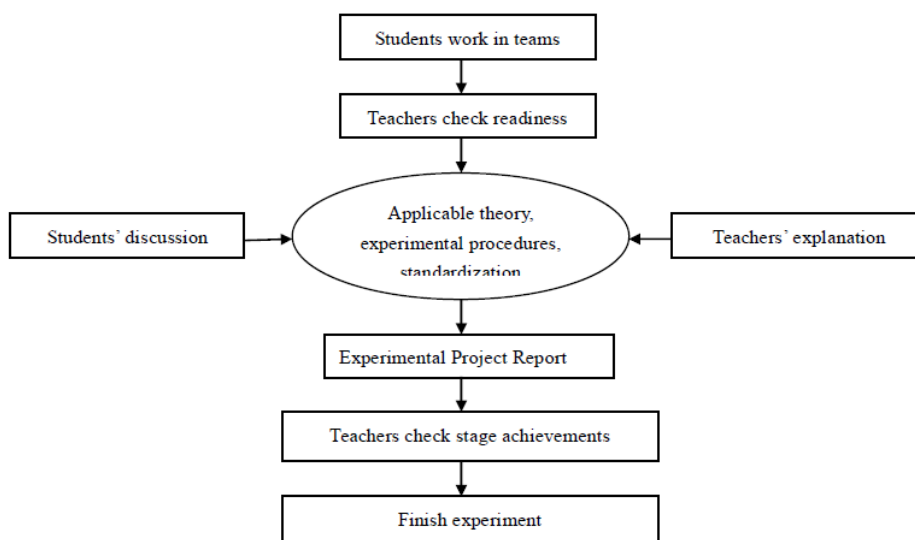


Fig.1 Experiment method and mechanism

Conclusion

Open Experimental Teaching Research provides a reliable guarantee for cultivating the students with innovative ability and research capacity. Simultaneously, scientific research maximizes the use of teaching resources, break through the traditional teaching model, absorb and introduce the advanced teaching model and ideas. Moreover, combining the theory with practice closely is in favor of meeting the needs of the community and cultivating applied talents.

Reference

- [1] X. Jiandong, W. Haiyan, H. Zong, On the innovation of open experiment management mode in colleges and universities, *Experimental Technology and Management*. 2 (2009)22-26.
- [2] P. Zhijun, L. Jianhai, Y. Min, L. Yunfeng, Study and exploration of the mode of open experiment teaching, *Experimental Technology and Management*. 5 (2010)27-29.
- [3] Y. Zhiguo, L. Youzhi, L. Tongchuan, Exploration and Practice for Open Type Experiment Teaching of Chemical Engineering Principle, *Guangdong Chemical Industry* . 3 (2011) 128-130.
- [4] T. Aiguo, Research on Multilevel and Open Teaching Model of Electrical and Electronic Experiment, *Research and Exploration in Laboratory*. 8 (2010) 127-129.
- [5] D. Ary, L. Jacobs, C. Sorensen, D. Walker, *Introduction to research in education*, Cengage Learning, 2013.
- [6] W. Huang, Innovation is the Key to Promote Experimental Teaching and Laboratory Building, *Research and Exploration in Laboratory*. 4 (2004) 1-4.
- [7] Z. Chen, *Study on Innovative Experiment Model for Excellent Civil Engineer Education*, Atlantis Press, 2015.
- [8] W. Liang, Z. Zhihong, W. Wenhua, T. Ran, Development of an Intelligent Management System for Laboratories, *Research and Exploration in Laboratory* .5 (2012) 169-172.
- [9] M. Jie, G. Hong, Research and Application of a Two-dimension Practical Teaching System, *Research and Exploration in Laboratory*. 4 (2012) 111-113.
- [10] M. Berman, J.S. Chase, L. Landweber, A. Nakao, M. Ott, D. Raychaudhuri, R. Ricci, I. Seskar, Geni: A federated testbed for innovative network experiments, *Computer Networks*. 61 (2014) 5-23.