

# Cultivating Students' Innovative Ability by Scientific Research Projects

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**Abstract**—Objective of this study is to improve students' innovative ability, stimulate students' interest in scientific research, and improve their innovative ability. This study takes college students as the research object, guided by scientific research projects, and introduces scientific research thinking into the process of cultivating students' innovative ability. The actual results prove that participating in scientific research projects can improve students' innovative ability, thus exploring a suitable application. A new approach plays a part in the development of students' innovative abilities. In the process of students' participation in scientific research, through the active guidance of the instructors, students' interest in scientific research is greatly stimulated and the innovation ability of college students is improved.

**Keywords**—Scientific Research Project; Innovative Ability; College Students; Teaching Reform

## I. INTRODUCTION

Higher education is an important part of China's education. It is committed to cultivating innovative and versatile talents. It is always an important research topic in our higher education to explore ways to cultivate innovative talents [1]. The *National Innovation-Driven Development Strategy Outline* issued by the Party Central Committee and the State Council in 2016 emphasized that technological innovation is a strategic support for improving social productivity and overall national strength, and must be placed at the core of the overall development of the country, while the cultivation of innovative talents is the fundamental guarantee for building an innovative country. Several Opinions on *Further Strengthening the Work of Educating People in Colleges and Universities* in 2012 emphasizes that higher education institutions should foster innovative talent-training models, strengthen practical education links, strengthen college students' innovation and entrepreneurship education, and support students to conduct research [2]. It has become a new concept of higher education development and innovative talent training model. Throughout the relevant training mode of innovative talents in universities and colleges at home and abroad, creating scientific research training opportunities for undergraduates and arranging scientific research training programs are effective ways to cultivate innovative talents. The *Undergraduate Research Opportunity Program* of the Massachusetts Institute of technology supports and encourages undergraduates who meet

certain conditions to participate in teacher research projects [3]; The *Student Research Program* in Tsinghua university's aims to provide scientific research training opportunities for university students [4]. It aims to provide opportunities for college students to engage in scientific research and training, so that students can enter the professional scientific research field as soon as possible. Also, it is beneficial for students to contact the frontiers of the discipline, clarify the development of the discipline, and learn to be independent, cooperative and innovative. Scientific research is an important means of cultivating those innovative and applied talents and improving the quality of education and teaching. The integration of science and education using scientific research, feeds back on teaching, and the promotion of scientific research through teaching are effective means to promote the combination of the two. In 2012, the *Ministry of Education's Opinions on Comprehensively Improving Higher Education* proposed to promote the interaction between scientific research and teaching, transform scientific research results into teaching content, and innovate talent training models. How to introduce scientific research into the cultivation of applied talents has always been a concern of scholars in education field. At present, some applied undergraduate schools have introduced teachers' scientific research projects into the training of students, and have achieved good results [5].

College students enter teacher's research group, participate in instructor's research projects, and have a clear division of tasks. This education model is similar to the graduate student training model. This training mode promotes face-to-face communication between teachers and students. Through the active guidance of the instructors, it can stimulate students' research interests and improve their innovation potential. In the traditional classroom teaching, there are many students, and the tasks other than the teacher's teaching are also heavy. The communication between students and teachers is less, and the students are more likely reluctant to communicate with teachers about their ideas. This training mode just overcomes these disadvantages, which can build a platform for face-to-face communication between students and teachers. Students share their innovative ideas with teachers, put them into practice at the same time, improve their ability to innovate and effectively promote projects to carry out. Scholars, take Muhahi for example [6], introduced scientific research topics into undergraduates' teaching, improved students' sense of innovation, and achieved good results. Bao Jie [7] introduced

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his own research projects into electronic technology teaching, which makes classroom teaching become more visual and intuitive. Students combine theoretical study with engineering practice to enhance their interest in learning and their ability to accept new things, ultimately improve students' innovation ability. Li Yue [8] incorporating students into her own research projects in the process of scientific research, enhances students' innovative thinking ability, cultivates students' application innovation ability, and achieves good results.

The instructor introduces his own research project into the classroom and stimulates the student's research interest. Students can take initiative to sign up for the teacher's research project. The instructor screens the students to participate in their own research projects. During the process of participating in the teacher's scientific research project, the students improve subjective learning ability and research interest through the active guidance of the instructors. Finally, in the process of scientific research, including students' graduation design, participation in provincial or school-level xinniao talent program, innovation and entrepreneurship contest and "Internet Plus" competition scores as the evaluation means, students' research enthusiasm and innovation ability have been clearly improved, and finally come up with valuable research results.

## II. PROJECT-BASED GRADUATION DESIGN AND XINMIAO TALENT PROGRAM, INNOVATION AND ENTREPRENEURSHIP CONTEST

### A. Student screening

Chose sophomore students as the sample for the reason they need professional knowledge, who have already contacted professional courses. At the same time, the assessment of the research process requires student's graduation design as the assessment result, and the research process will last for 1-2 years.

A total of 63 students in the pharmacy profession, were introduced the instructor's research projects (the discovery and application of pathogenic bacteria inhibitors in the symbiotic microbes of the North Bay Brassica), which were applied in their teaching process, stimulated students' interest in scientific research, and attracted students to participate actively. Ten students enrolled in the teacher's research project. Three of them were selected to participate in the research project.

### B. Innovative ability training stage (three stages)

Review literature stage: this stage is the guiding stage of scientific research. The teacher guides three students to familiarize with their research topics, clarify their research tasks, and guide them on how to quickly access the literature and filter useful foreign literature. By reading a large number of references, students are familiar with the subject research. At the same time, teacher will give some demonstrations on the basic operations of the experiment, and let students practice. Through this stage of study, the students will be familiar with the research content of the subject and master the experimental operation methods through the research process.

Innovative ability training stage: students summarized the documents they have consulted, and design their own research framework (research route, research methods and analysis of

results) in the form of group discussions based on the research topics given by the instructors. Then they report in the form of seminar, discuss the problems encountered when designing the route with the instructor, and listen the instructor's advice about their problems. As for the problems they encountered, the instructor does not directly tell them how to solve it, but tells them how to see the problem, how to find the answer, and the instructor will guide them to see the problem from multiple angles. It is also possible for students to complete the process independently, when teachers are not involved in the process of solving problems. The purpose is to examine the role of teachers' active guidance in cultivating students' innovative abilities in the process of participating in research projects.

Intensive phase: After going through the previous two phases, students have mastered the ability to find references, design research content, and analyze results. On this basis, the instructor gives student a topic that allows students independently conducting project research. In this process, we found that students are relatively becoming skillful, because they have the ability to learn from the initiative, know what to do, how to find the answer without knowing the knowledge, and finally complete the task smoothly.

### C. Evaluation process of students' innovative ability

At present, there is no unified standard for the evaluation of students' innovative ability. In the process of completing graduation thesis, the xinniao talent program, the innovation and entrepreneurship contest and the "Internet Plus" contest, there are certain requirements for students' innovative ability. Therefore, according to base on the evaluation criteria of students' innovative ability, they will complete their graduation thesis based on the participating research projects, and participate in the provincial and school-level xinniao talent program, innovation and entrepreneurship contest and "Internet Plus" competition.

From the perspective of the entire process of participating in teacher research projects, students' ability of actively learning is significantly improved. In the process of completing graduation thesis, completing the xinniao talent program, the innovation and entrepreneurship contest and the "Internet Plus" competition, the design of the thesis and the completion of the entries require a strong initiative to learn and innovate. In order to win awards in the xinniao talent program, the innovation and entrepreneurship competition and the "Internet Plus" contest, students are required a strong ability to innovate. The graduation thesis, xinniao talent program, and innovation and entrepreneurship competition are all completed by the students themselves in my group. The teacher only plays a supporting role. This also fully shows that students have greatly improved their subjective initiative and innovation ability by participating in the teacher's research projects. The active guidance of teacher has greatly promoted the cultivation of students' innovative ability.

## III. CONCLUSION

The purpose of the research project is to strengthen students' sense of innovation and practical ability. The content of the project research should have certain new ideas, but it is still different from scientific research. Due to the influence of

exam-oriented education, students often lack the ability to think independently when choosing a topic. They may copy the contents of the tutor's research project, but only slightly change the topic and expression. Such project usually lacks new breakthrough points, but just copy teacher's ideas. Therefore, how to determine the project research content based on the knowledge learned by participating students is the primary concern of research projects. The research content of college students' innovation projects should be moderately difficult. If the research content is too difficult, students may overburden extracurricular courses and are affected with professional learning. If the research content is too simple, there is no meaning, and it deviates from the purpose of the establishment of the college students' innovation projects. "Interest is the best teacher". The project selection should combine the students' interests and abilities, and also closely combine the professional knowledge of the current students. In this way, the purpose of both scientific research and training can be achieved, and students can retain their space for subjective initiative and creativity, and stimulate students' interest in scientific research.

Team coordination and cooperation is especially important in the implementation of college students' innovation projects. Because no matter how good a person is, it is impossible to be all-round developed and proficient in all content. If the team members can't get along well with each other during the project implementation process, they will not be humble and cooperating. Everyone only cares about their personal interests, and the project will be difficult to be carried out. The smooth implementation of college students' innovation projects requires the cooperation by each team member, because various difficulties may be encountered in the practice of the project. For example, sample collection needs team members go to different locations, and communication and coordination with different groups of people are also needed. The experimental results are not ideally, it is necessary to check the test several times, check if the experimental equipment or facilities have problems. What's more, most of the projects are carried out on weekends or holidays, which sometimes inevitably conflicts with private affairs of students. Only the cooperation of the team can solve these problems.

The important process of teaching research and cultivating innovative talents in colleges and universities should be based on the college students' innovation and entrepreneurship action plan and the university students' scientific research training plan. Building an innovative laboratory as a carrier and a platform for college students' innovation and entrepreneurship,

it cultivates students' scientific and educational literacy and scientific spirit. Real integrate transformation of pharmaceutical research results in innovating ability of college students and promoting each other. The results of this paper prove that:

(1) Scientific research projects can stimulate students' scientific enthusiasm and innovation consciousness. In the process of participating in scientific research, they can effectively cultivate students' ability to discover problems, analyze problems and solve problems well. This can cultivate students' innovative consciousness and stimulate creative thinking.

(2) In the process of students participating in scientific research projects, the guidance from professional teacher is necessary, and the correct guidance of professional teachers can effectively enhance students' innovative ability.

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