

# Discussion of Undergraduate Participation in Scientific Research Activities and its Role in Cultivating Innovation Ability

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## Abstract

Undergraduates participate in scientific research practice at the undergraduate level, which can improve their scientific research level, and it has the function of cultivating innovative thinking and other functions. This article introduces the status quo of undergraduates' participation in scientific research activities and the significance of participating in scientific research activities. Moreover, some thoughts and suggestions are put forward for college students to cultivate their innovative ability through scientific research activities.

## Keywords

**Innovative Ability; Undergraduates; Scientific Research Projects; Innovative Talents.**

## 1. Introduction

At present, undergraduates still account for the main part of the high-quality talents cultivated in our country. According to statistics, the number of university graduates in 2020 will reach 8.74 million, an increase of 400,000 over 2019. With the popularization of the concept of revitalizing the country through science and education and the rapid development of scientific research, the society's requirements for talent innovation and undergraduate professional abilities have increased, so undergraduates need to cultivate their innovative abilities [1]. The talent training mechanism is also constantly reformed by the needs of society, in my country's higher education. For example, undergraduates are encouraged to participate in scientific research projects, professional innovative competitions, and publish academic papers. At the same time, it has become a trend for undergraduate graduates to study for a master's degree after graduation. If universities want to improve the scientific research level of prospective graduate students, they need to pay attention to the scientific research level and innovation ability of undergraduates.

## 2. Undergraduates' Current Ability to Innovate

### 2.1. Definition of Innovation Ability

Innovation ability refers to the potential quality and ability to develop and innovating new things after college students have mastered the original knowledge and experience. This kind of ability is specifically for undergraduates, mainly after the undergraduates have completed the necessary in-class tasks. Through the induction and analysis of problems, practical innovation can cultivate students' innovative thinking. Students can think about the difficulties they will face in the future and are not affected by ordinary thinking. They can analyze problems from a special perspective and propose innovative solutions. They can finally come up with a unique, novel, and more socially meaningful results.

## 2.2. The Significance of Innovation Ability to Talent Training

First, the significance of the country. The overall innovation ability of undergraduates is one of the important components of the national scientific research level. Innovation ability can enhance the country's comprehensive national strength and realize the country's technological modernization and autonomy. Second, the significance of society. The demand for innovative talents is increasing day by day. If graduates can innovate, their employment prospects will be better and they will be more easily recognized by society. Third, the significance of colleges and universities. College students are recognized by the company and society for their innovative ability, so the reputation and social influence of colleges and universities can be improved. Therefore, the development of colleges and universities is promoted by this kind of education, so that the talent training system forms a virtuous circle. Finally, the meaning for college students themselves. In addition to mastering the knowledge learned in class, they can better understand professional knowledge if they can innovate. This ability can enhance their professional capabilities and make them more competitive [2]. All in all, the improvement in innovation ability of undergraduates is an indispensable part of the cultivation of talents.

## 2.3. The Main Ways for Undergraduates to Cultivate the Innovative Ability

There are many ways for undergraduates to cultivate the innovative ability. And the combination of theory and practice is one of the main ways. As undergraduates' demand for innovation capabilities continues to increase, colleges and universities have added courses for cultivating students' innovation capabilities, requiring students to receive theoretical guidance. At the same time, students can also cultivate their innovative abilities by participating in teachers' scientific research projects, participating in innovative competitions, or completing curriculum design during their studies.

## 2.4. The Current Problems in Cultivating the Innovation Ability of Undergraduates

At present, colleges and universities still have many problems in the cultivation of students' innovative ability, and they are in the stage of exploration and improvement. First, students do not take the initiative to cultivate innovative abilities. Under the current background of exam-oriented education, students generally think that it is enough to master the knowledge in the course of undergraduate. Students often lack innovative practice in their studies. Although some students practice innovatively, they no longer persist because of difficulties and lack perseverance. Second, the scientific research platform and environment provided by universities are imperfect. When undergraduates intend to participate in innovative practice, although they have put in a lot of effort, the final plan must be shelved due to lack of professional guidance and lack of policy and financial support.

## 3. Current Situations of Undergraduates' Participation in Scientific Research Projects

### 3.1. The Purpose of Students Participating in Scientific Research

The purpose of undergraduates' participation in scientific research practice is also inconsistent, which can be divided into two aspects: internal motivation and external pressure. For example, some students want to exercise their scientific research ability by contacting research in professional fields. To have a deeper understanding of the major, students practice what they have learned. Some students also try scientific research activities because they are personally curious about scientific research and consider whether to develop in scientific research in the future. This is an internal motivation that arises from the needs of personal development. Of course, the acquisition of awards and honors is the purpose of some students' participation in

scientific research activities. Some colleges and universities have formulated a series of encouraging policies to encourage students to participate in scientific research activities. For example, awarding credits, as a basis for scholarship recognition or exemption of graduate student requirements, etc. This way is to promote students' participation in scientific research activities from external forces.

### **3.2. Form of Student Participation in Scientific Research**

Undergraduate students can participate in the scientific research activities of their tutors in the implementation of the tutor system for undergraduates research the guidance and guidance of teachers [3]. Students can also participate in scientific research competitions at all levels, such as " Challenge Cup ", " Internet + " and other professional innovation competitions at all levels. Some students also participated in the " University Students ' Innovation and Entrepreneurship Training Project " and further carried out scientific research activities by applying for the project. Regardless of the form, active participation in various scientific research activities is conducive to the improvement in undergraduates ' scientific research capabilities.

### **3.3. The Results of Students Participating in Scientific Research Activities**

Undergraduates' participation in scientific research activities can not only improve their scientific research level, but they can also compare with the professional theoretical knowledge they have learned. Students' understanding of the content of the textbook has been deepened, and their ability to solve problems has been exercised through thinking and analysis. Besides, students' scientific thinking and innovative abilities are also cultivated. In addition to the improvement of students' quality, undergraduates can publish scientific research papers through the results obtained by participating in scientific research. Students at all levels to participate in the innovative competition, patent, or research future career development of students and plans have a positive effect.

### **3.4. The Current Problems Faced by Students Participating in Scientific Research**

There are more and more opportunities for undergraduates to participate in scientific research activities, but there are still many problems to be solved. Students do not have clear goals when participating in scientific research projects, and they may blindly follow suit. The research direction was decided hastily by the students without serious thinking. Because the research process has not been planned and summarized in detail, although students have participated in scientific research activities, the results obtained cannot meet the requirements. The experiment efficiency is low. In addition to the students ' factors, there are also problems with university management. Nowadays, the curriculum planning for undergraduates in colleges and universities is more inclined to theoretical education. Students learn the basic professional courses after the public basic courses and then learn the professional theory courses. More time for students is devoted to the study of theoretical knowledge, resulting in not interested in scientific research activities. In the environment of exam-oriented education, mandatory participation in scientific research activities is perfunctory. Therefore, school-related systems still need to be improved. On the other hand, the source of funds for students to participate in scientific research is also a major issue. Whether students publish papers, apply for patents, or participate in various competitions, they must rely on financial support. Will limit the development of scientific research projects, in the case of insufficient project funds. Undoubtedly, undergraduates still need to overcome many difficulties to participate in scientific research activities [4].

## **4. Significance of Undergraduates' Participation in Scientific Research Activities on the Cultivation of Their Innovative Ability**

### **4.1. The Comprehensive Ability of Students is Improved**

For undergraduates, participating in scientific research practice can have a deeper understanding of professional knowledge. It can also enhance students' interest in exploring unknown areas. Scientific research activities can cultivate students' hands-on ability, teamwork ability, data analysis ability, and other abilities. Improve students' comprehensive ability. Students mainly study theoretical knowledge at the undergraduate level, and they will inevitably encounter problems of incomplete understanding. These problems may bring troubles and obstacles to relevant work in the future. Students can research difficult problems if undergraduates have some innovative abilities or master some research methods. Students analyze existing problems, solve and understand this theoretical knowledge, and practice by themselves [2]. The method of combining theory and practice is an effective way to learn theoretical knowledge. Not all students can master this ability. If students can innovate, they will be able to practice better. Under the current background that innovation equals productivity, students with innovative ability can get more benefits to society and have stronger competitiveness. Therefore, the cultivation of undergraduates' innovative ability is crucial to the improvement of comprehensive ability.

### **4.2. Education and Teaching Reform in Colleges and Universities was Helped**

For the country, undergraduates are still the main force of higher education. By improving the innovation ability of undergraduates, it can promote the country's scientific and technological progress and promote the reform of education and teaching in colleges and universities. With the increase in the number of undergraduates, to meet the needs of my country's scientific research field and further deepen the reform of education and teaching in colleges and universities, undergraduates' innovative ability needs to be cultivated [5]. However, it is not enough to rely on the efforts of individual students and some colleges and universities. At the same time, it needs to rely on the promotion of national policies. The "Notice on the Development of New Engineering Research and Practice" issued by the Ministry of Education in 2017 emphasized the need for innovation in the engineering system. In recent years, opportunities for undergraduates to participate in scientific research activities have increased. Colleges and universities attach great importance to cultivating innovation ability, which has helped the promotion of college education and teaching [2].

### **4.3. Meet the Needs of Social Development**

For society, the improvement in undergraduates' innovative ability can meet the needs of social development. With the upgrading of the overall technological level of society, the innovation abilities of graduates cannot meet the needs of research institutions or enterprises. Through participating in scientific research activities during their studies, undergraduates have cultivated scientific research capabilities and improved their qualities, laying a good foundation for future work in various fields. It is easier to adapt to social development and gain social recognition than students that do not possess these qualities.

### **4.4. Broaden the Knowledge Learned and Understand Professional Issues in Depth**

Undergraduates can study theoretical parts related to their majors in the classroom. Be able to have a basic understanding of the field you are engaged in class. Students participating in extracurricular scientific research activities can broaden their horizons and gain an in-depth understanding of problems in the professional field. In the process of participating in scientific research activities, students can actively search for relevant knowledge due to the guidance of

the research direction and are influenced by the research to learn more scientific knowledge, develop innovative thinking, and become interested in professional issues. Students' learning channels will also be broadened, and their understanding of professional issues will be deeper. Also, in the process of participating in scientific research activities, students can communicate with professional teachers to supplement graduation plans.

#### **4.5. Basic Skills Conducive to Innovation and Development are Mastered by Students**

In the process of undergraduates participating in scientific research activities, the teacher usually indicates the research direction, and then the students independently search for various documents and select useful information based on their own research needs. Students compare the information they found with their research, and after discovering the deficiencies in the experiment process, they draw up an improvement plan, correct the research route, or other measures. Through these measures, relevant professional knowledge, scientific research skills, and innovative skills are mastered by students. These skills can promote the cultivation of innovation ability of undergraduates and can improve the comprehensive strength of students.

#### **4.6. Conducive to Cultivating Innovative Spirit**

In the process of students participating in scientific research activities, the students' serious research attitude and the scientific research style of daring to practice are cultivated. There is also an attitude of seeking truth from facts in scientific research and knowing the truth from practice. First of all, students need to understand and analyze arduous problems, so the experimental skills are improved. Second, students will further develop new explorations on the original basis, and use innovative thinking to understand the frontiers of research, which will help cultivate the spirit of innovation. At the same time, working with the team in the process of exploration has also cultivated the team spirit, which is indispensable to the research field.

#### **4.7. Help Improve the Professional Competence of Undergraduates**

College education should not only enable students to master theoretical knowledge, but also require students to master relevant professional skills. These skills can enable students to adapt to future changes in the industry and improve their competitiveness. In the context of increasingly fierce social competition, society's requirements for talents are constantly changing. Because our country is in a critical period of socialist modernization, it needs more high-quality and professional-quality talents to join. Because most professional talents are trained by universities, the training programs must conform to the needs of society. To thoroughly implement the "Higher Education Law of the People's Republic of China", colleges and universities can gradually cultivate students' innovative ability by encouraging students to participate in scientific research activities. Only when undergraduates learn the ability of innovation can they meet society's demand for talents and improve the comprehensive competitiveness of graduates [6].

#### **4.8. Specific Case Analysis of Undergraduates Participating in Scientific Research**

During the second year of the university, the author participated in scientific research projects and several innovative competitions under the guidance of the tutor. Based on my own scientific research experience, the author believes that participating in scientific research activities can effectively cultivate innovation ability. For example, when the author participated in the mung bean germination experiment in a salt-alkali environment, the author went through the following experimental steps. Such as Select seeds, prepare disinfectant, disinfect petri dishes, observe and record the number of mung bean germination, replace culture fluid, and

filter paper. After the author completed the last experimental stage, the sample size was calculated through PASS, and the germination results were analyzed to obtain the final experimental results. Through reading the papers, hands-on operations, teachers and seniors and sisters helped, the author learned how to use pipettes, precision balances, and conductivity meters. And set up experimental methods such as control and conversion methods. The author has a strong interest in the deeper level of this major, and more importantly, the author's scientific research level has been improved. While participating in scientific research activities, the author also participated in innovative competitions. All in all, because students have participated in scientific research activities, they have an understanding of experimental methods. Therefore, students can use innovative thinking, combine their knowledge with real-world applications, and then carry out more kinds of attempts. Choose the direction that suits the students' development from the attempts, and have a clearer plan for their future.

## 5. Conclusion

In summary, participating in scientific research activities for undergraduates is one of the most effective ways to cultivate their innovative abilities. The following suggestions are the solutions proposed by the author, aiming at the difficulties faced by undergraduates in participating in scientific research activities.

### 5.1. Undergraduates Actively Participate in the Supervisor's Experiment

When undergraduates enter the university, they do not learn relevant professional knowledge, do not understand scientific research activities, and participate in scientific research activities randomly and blindly. The research direction chosen by the students may not be suitable for their future development. If they follow the tutor in scientific research activities, under the professional guidance of the tutor, they can find errors in time and correct their directions. And the instructor can also choose the research direction that suits the students, according to the students' conditions, so they can better improve the students' scientific research level. In short, by participating in the mentor program, students can cultivate innovative thinking and enhance their innovative ability.

### 5.2. Establish a Sound Incentive and Evaluation Mechanism

At present, colleges and universities pay more and more attention to the scientific research ability and innovation ability of students. Students participating in scientific research activities not only need their interest in scientific research activities but also rely on the support of relevant school policies. Students generally need to get results after participating in scientific research activities. The school should affirm the achievements of the students and give them some rewards. In this way, more students are encouraged to participate in scientific research activities and obtain more research results. Form a virtuous circle to improve the overall scientific research level and innovation capabilities of the school.

### 5.3. Solve the Difficulties Faced by Students in Scientific Research Activities

At present, undergraduate students still face many difficulties in participating in scientific research. For example, the students involved in scientific research have not learned professional knowledge. Students cannot complete the scientific research tasks assigned by their supervisors on time. There is no standard policy system for students' participation in scientific research activities in the university where the students are located, or there is no unified management institution. Therefore, various reasons prevent students from participating in scientific research activities in a long-term and effective operation. In order to solve the problems faced by students, the participation of students in scientific research activities requires the coordination of multiple resources. During the research process,

equipment, venues, and funds need to be effectively deployed [2]. Participating in scientific research activities is a vital part of cultivating students' innovative ability, and it is still in its infancy. To cultivate innovative talents, the support and joint efforts of students, universities, and society are needed.

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