

Exploration of Innovative Laboratory Construction and Team Training in Colleges

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Abstract—The cultivation of innovative ability is one of the critical problems in the quality of College Students' talent training. This study, based on the operation and construction method of the open innovative laboratory, puts forward the laboratory management system in patterns of the project operation, echelon training and real-time communication. Given the relationship between teachers and students during the process of innovation and cooperation, this research also proposes the program of sustainable development of the innovation team training, including the ladder type exploration of innovation ability in terms of introduction-improvement-competition-research. After several years of practice, it has been proved to play a promotive role in the cultivation of students' innovative and practical ability.

Keywords—Innovative ability; Laboratory construction; Team training; Management mode

I. INTRODUCTION

Nowadays, with advanced science and technology revolution sweeping the globe and the emerging high-tech industry becoming a new economic growth point, social wealth is gathering to the countries and regions rich of knowledge and technical advantages. The more advantages it takes in knowledge and technological innovation, the more active position it occupies in the development. China's Ministry of education also pointed out that deepening reform of high education is an urgent demand for the implementation of innovation development strategy and promotion of economic quality and efficiency, and also an important measure to promote the comprehensive reform of high education and high quality employment of college graduates. Therefore, the objective situation requires us to take the scientific and technological progress as a powerful driving force to accelerate economic and social development, whereas the progress of science and technology can't be separated from

innovative talents with innovative ability. High education is committed to the important task of training high-quality talents to adapt to social development, and also its unshrinkable responsibility to train innovative talents.

However, the quality of college students faces severe test due to the current enrollment, coupled with the traditional education mode heavily influencing college students. Actually, there are different degrees of weak or even lack of autonomous learning and innovative consciousness [1]. Therefore, the crucial problem lies in enhancing the cultivation of college students' scientific and technological innovation ability [2]. Under the policy support from the Ministry of education, many universities especially the "211" and "985" Engineering Universities have made a series of practical and beneficial exploration in deep research and extensive exploration of college science and technology innovation, whereas some local colleges failed to do so due to various reasons. There are still some universities try to do research and practice in this field [3]. At present, our School of Mechatronics in Shandong Management University has set up a laboratory for science and technology innovation, under the spirit and policy guidance of the university. It has carried on the beneficial exploration and practice in the team construction of undergraduate students, and established a system suitable for the characteristics of running mechanism. Shandong Management University made full use of college students' science and technology innovation activities, and actively explored the effective training mode of innovative talents. It was finally brought into the undergraduate's teaching system. Thus, on one hand, the popularization of scientific and technological innovation activities of undergraduate students has been realized, on the other hand it has provided a solid guarantee for the scientific and technological innovation activities of undergraduate students. It formed a long-term mechanism of innovative education.

II. OPEN INNOVATION LABORATORY

Laboratory, with relatively open environment and technology, is the basic platform for talent training in universities, the source of innovation and the base for technical talent training. Combined with the construction and management process of the laboratory in Shandong Management University, it is easy to find that the construction of the laboratory directly determines the technical ability of the students, and the whole process is beneficial to improve the students' ability of independent management and research. The laboratory was constructed in terms of teaching staff construction and team construction to explore the training mode of technical and practical talents [4], which was crucial for the training of practical talent.

A. Purpose of Open Innovative Laboratory

1) Improving students' independent ability

We formulated a unified automatic management system for the innovative laboratory and took automatic management including project, echelon, exchanging and other forms. We constructed such automatic learning and management mode as leading by teachers and operating by the students. The students' self-control ability and their sense of ownership have been highlighted. Innovative lab belongs to the students, all of the device management, equipment management, talent arrangement, laboratory management and the introduction of every new comer, different forms of staff selection, interaction, the usual study, the main activities were organized by the students themselves.

2) Improving students' research ability

It provides students with broad and free learning space through open innovative experiments, and helps them find their interest points and development direction according to their professional characteristics. They carried out independent scientific experiments and technological innovation during their spare time so as to improve their research ability. Meanwhile, college innovation team also organized a meeting for teachers and students through lectures or professional symposia to present their scientific research and engineering experience. In accordance with their own interests and schedules, they chose their professional directions and professional instructors. Teachers gave them comprehensive guidance in the two years' practice engineering course, including literature review, project selection, project practice, technological innovation and graduation thesis. The capable students can also enter the project team, research study and work, which were combined with their work of the graduation thesis or academic papers.

B. Management modes of open innovative laboratory

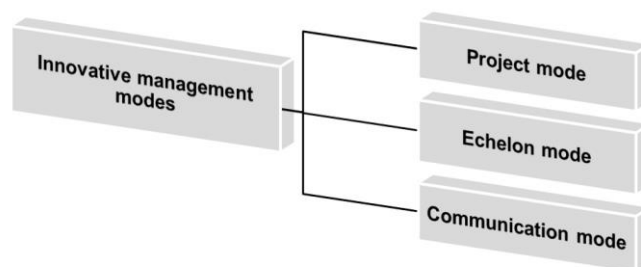


Fig. 1 Schematic illustration of management modes of open innovation laboratory.

1) Project mode

The project can be derived from the students' self reporting, such as college students' innovation and entrepreneurship training programs, from the teachers' proposition, such as successive Electronic Design Contest of the undergraduate, and from the teacher's own research projects as well. Students selected the project based on their interests. Responsible person recruited students of different majors and grades to create a team. Each team was charged by their own responsible man, including the entire project task decomposition, team communication and cooperation, risk identification, cost management and tracking members to complete the schedule.

2) Echelon mode

The laboratory adopted the management of talent echelon [5], teachers are responsible for guiding the high grade students and dealing with some crucial issues on the project to help them coordinate the affairs between the laboratory and various departments of the school; while the high grade students played the leader role to organize some learning lectures and specific task decomposition to help the low grade students integrate into the whole team as quickly as possible. The students benefited from the echelon system, which can accordingly maintain the continuity of the team and the research.

3) Communication mode

Strengthening the relationship between teachers and students is the foundation of the laboratory. Conveying the teachers' latest information to the students and students' feedback to the teachers in real time is significant. In order to ensure the communication between teachers and students, we took the following two kinds of timely and reliable measures:

(1) Carrying out regular reports and seminars. Teachers held a brief report and discussion to understand students' study progress and research progress and gave targeted guidance. Each team project was given a summary discussion, the problems encountered in the project can be solved, and new tasks can be timely arranged and allocated to form the stage task.

(2) Construction of dialogue platform between teachers and students. Teachers and students made use of network to conduct real-time communication through text, voice or image to convey their learning problems to teachers and resort to

them. Students also communicated to deal with some simple problems themselves, and screened some puzzling problems to the teachers. Teachers also used this platform to release information and tasks and recruit students, which achieved truly real-time communication, real-time online exchange.

C. Preliminary results of open innovation laboratory

Open innovative laboratory provided more ordinary students with the opportunity to enter the laboratory and enjoy the creation, and the access to some of the research projects. We shared the resources and made rational use of laboratory resources, thus greatly improving the utilization efficiency of the laboratory. The most important is to enhance students' enthusiasm for innovation and improve the students' innovative ability. The students' automatic management model not only improved the students' comprehensive practical ability, but also to a certain extent increased the utilization of teachers' resources.

III. CONSTRUCTION OF INNOVATIVE TEAM

A. Team spontaneity

Our team adopted the strategy of cooperation with division of labor and skills sharing and is composed of those who love thinking and working. If we met interested items, we would team up to overcome difficulties and challenges. In the innovative laboratory, the students shared the fun of the combination of knowledge and technical experience; got "knowledge" in research and "cooperation in team" [6].

1) Maintaining sustainability of innovative team through talent echelon

Our laboratory took the talent training mode and set up a sustainable development innovative team, making full use of the role the team plays. We attracted recruitment with "innovation" gravity to let the high grade students guide the ones in lower grades, and give them the ladder innovative training process of "elementary course-improvement-competition-research". Students are the principle part of innovation team, but they can only spend limited time in participating in the innovation team during their four years' college life. Graduates left every year, there were new members to join in. Therefore, it was necessary to ensure a certain talent echelon, so that each grade students had their own posts and development orientation. At the same time, the construction of student innovation team took the collocation of elder and younger ages and different professional collocation into account to meet skills sharing and also encouraged the superiors to assist the inferiors.

2) The role of teachers in innovative teams

The participation and guidance of professional teachers is the guarantee for the development of extracurricular scientific and technological innovation activities. Although the main part of innovation activities is students, its development is not separated from the teacher's attentive guidance. Therefore, the teachers that participated in the innovation lab possessed a strong sense of responsibility, professional ability, strong research ability and practical ability; they cannot simply pass on knowledge, but also cultivate students' ability,

quality, and a learning style of education in the guidance. In the meantime, the teachers of innovation team focused on the combination of courses and majors in structures. They directed students in research methods and research ideas, exercised their spirit of science and culture and instructed the students to complete the task of scientific and competition research.

B. Project driven

The essential purpose of the innovative project is to improve students' ability of "creation" and "practice". We gave the right of initiative, thinking and completion to the students. The integration of ideas and the collaboration among the members of the project team ultimately determined whether the project can be completed at a high level, to some extent also determined whether the students' innovation ability was effectively improved. The exploration and cooperation mode was employed to complete the project, that is: the project as a carrier, documentation was completed through group cooperation, issues was dealt with by means of research and discussion (cooperative inquiry), the teachers needed to grasp the research direction in the crucial time; this way, within the team was called the "project based on cooperative inquiry learning mode " and was implemented in "smart helmets" project. It has been proved that the students' innovative and practical ability has been greatly improved.

IV. SUMMARY

In the exploration of the construction of open innovation laboratory, through the rules of the security, the mode of innovation management mode and the operation of the project type, echelon type, real-time communication, it has strengthened the communication between teachers and students, basically meet the normal operation of the open laboratory. Although there are still many aspects to be refined in some specific implementation, it undoubtedly provides a basis for the laboratory of independent management and development.

As an important part in the system of innovative country, science and technology innovation team in local universities is still in the process of exploration in practice. It is yet to be further explored on how to flourish the development of innovation ability of the local College Students. In practice, it is still demanded to be adjusted according to the different types of universities and discipline features. I believe that in the near future, through the cultivation of innovative laboratory construction and innovation team, more talents will emerge to meet the society needs.

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