Exploration and Practice of “2.5+1.5” Talent Training Mode—A Case Study of Innovation Class*

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Application-oriented innovative talent training is an important task for application-oriented undergraduate colleges and universities. In order to comprehensively improve the quality of talent training and explore the effective way of application-oriented engineering science and technology talent training, our university takes “innovation class” of information as the breakthrough point. The talent training mode, the teaching staff, the curriculum system, and the teaching methods are explored, and the “2.5+1.5” talent training mode and its management mechanism are also explored, trying to play a certain exemplary role for the education teaching reform of engineering in the same type of colleges and universities.

Keywords: innovation class, 2.5+1.5, application-oriented, talent training mode

Introduction

In the new era of economic globalization, international competition is becoming increasingly fierce, and the core of competition is the competition for talents. Cultivating a group of top-notch talents with innovative capabilities is an important guarantee to enhance the national international competitiveness. At the National Conference on Scientific and Technological Innovation, the Congress of Academicians of the Chinese Academy of Sciences and the Ninth National Congress of the Chinese Association for Science and Technology in May 2016, general secretary Xi Jinping stressed that the need to carry forward the spirit of innovation and cultivate talent teams that meet the requirements of innovative development. He clearly pointed out in the 19th National Congress that innovation is the primary driving force for development and a large number of international innovative talents should be trained. Colleges and universities shoulder the important mission of talent cultivation. Under the strong call and support of the party and the government, various colleges and universities in China have actively carried out the innovation and entrepreneurship training activities for students and most universities have set up innovative and entrepreneurial departments. Some colleges and universities have also set up innovative classes and conducted some research on the teaching system,

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curriculum system, training mode, and so on (Zhu, Zhu, Dong, Xie, & Ji, 2014; Fang & Zhao, 2016; Kang, Yuan, Fang, Chen, & Xiao, 2017; Yuan & Yang, 2018; L. Wang, Hui, Li, Wu, & H. Wang, 2018; Yu, 2019; Deng & Huang, 2019; Wang & Chen, 2020). How to cultivate top innovative talents and how to make students become innovative talents has become a hot topic of scholars (Mo, 2018; Zhou & Li, 2018; Qin, Hong, & Ma, 2018; Wang, Chen, Niu, & Fan, 2018; Wang, Chen, Niu, & Fan, 2019). Although innovation and entrepreneurship are in full swing in colleges and universities in China, there are still some problems, such as poor foundation, lack of innovation, insufficient combination of practicality and individualized development, and lack of stamina for innovative talents, and so on (Lou, Zou, & Li, 2017; C. Yang & J. Yang, 2018). As a result, the students trained are not strong in practical ability, lack of potential for independent learning and exploration of knowledge, poor ability to analyze and solve problems, lack of innovation ability, and unable to adapt to the needs of social development (Xu & Jin, 2014). In addition, different levels of colleges and universities have different foundations, so how to combine the foundation and characteristics of colleges and universities to cultivate innovative talents is also worthy of in-depth research. Combined with the characteristics of our university, this paper explores the “2.5+1.5” innovative talent training mode.

Selection Method of Students in the Innovation Class

The innovation class of our university began in 2013, and the students enrolled in that year were selected at the end of the first semester. The number of students selected is not more than 30, mainly through the combination of independent registration and selection. The selection method is as follows:

1. Select the students whose college entrance examination score is within 20% of the students in this major;
2. Students who meet first article can register voluntarily;
3. Based on the final examination results of three core courses in the first semester—English, Advanced Mathematics, and Programming Fundamentals, 60 students will be selected;
4. 30 students will be selected through the interview and be publicized for one week;
5. After the public announcement, the final list will be determined.

Talent Training Mode of Innovation Class

The innovation class aims at cultivating high-level application-oriented innovative technical talents, using high-quality education teaching resources, and adopting flexible teaching and management mode to cultivate application-oriented engineering technical talents with comprehensive development, high comprehensive quality, solid foundation, innovative spirit, innovative ability, and practical ability. In order to achieve this training objective, the “2.5+1.5” talent training mode is implemented, as shown in Figure 1.

This model is a compound model that comprehensively reforms the concept of talent training, teaching content, and teaching methods. The basic content mainly includes the following two aspects:

1. “2.5”, school training stage. In the first two and a half years, the scholastic year system will be implemented to teach general education, basic subject courses, and some professional courses. In addition, in the first two years, all the students in the innovation class study the same courses;
2. “1.5”, off-campus training stage. In the latter one and a half years, the credit system will be implemented. According to the needs of the cooperative enterprise and the orientation of talent training, the university and the enterprise shall jointly determine the training objectives and standards for the learning stage
of the enterprise. Students participate in the actual project development in the cooperative enterprise, which can replace the credits of corresponding courses in the talent training program.

![Diagram of "2.5+1.5" Talent Training Mode](image)

**Figure 1.** "2.5+1.5" talent training mode.

### Reform Measures of Innovation Class

**Reform of the Talent Training Program**

In order to better carry out innovative talent training, the talent training program of the innovative class has been independently formulated, which is quite different from the ordinary class. Guided by the concept of innovative application-oriented talent training, the talent training program emphasizes the cultivation of professional practice ability and comprehensive quality in accordance with the idea of “laying a solid foundation, broadening caliber, paying attention to quality, strengthening ability, and highlighting characteristics.” The main characteristics are as follows:

1. Broaden the professional caliber and increase the intensity of general education. There are six undergraduate majors in our college, namely, computer science and technology, network engineering, information management and information system, electronic information engineering, communication engineering, and Internet of things engineering. These majors are all information majors, which are not only a specialized research field, but also have comprehensive characteristics. Therefore, we first integrate the advantages of these six majors, take eleven basic subject courses as core courses, and build them into “quality courses”, as shown in Figure 2. Among these eleven courses, five courses, such as “computer networks” have become the high-quality resource-sharing course of Guangdong province, and four courses, such as “data structures and algorithms” have become the high-quality resource-sharing course of our university. At the same time, we also make full use of the overall advantages of teachers in our college to select and assign teachers with high professional titles and high levels to undertake teaching tasks and achieve resource sharing.

2. Consolidate the foundation. Information majors must be supported on a solid foundation to make the six professional directions have their own characteristics. The solid foundation is based on general education courses and basic subject courses, making full use of basic subject courses and some professional courses in “2.5” stage to cultivate students’ good theoretical literacy, laying a solid foundation for future professional
development. Through the in-depth study of the follow-up professional courses, students have formed their own characteristics of professional direction in terms of knowledge structure.

3. Concentrate professional compulsory courses and expand professional elective courses. Professional compulsory courses are the core course reflecting the characteristics of the specialty and have certain vocational orientation. The study of professional knowledge is solved by expanding elective courses, increasing the number of professional elective courses, highlighting the key points and difficulties, fully mobilizing the autonomy and enthusiasm of students in learning, broadening the scope of students’ professional knowledge, and reflecting the characteristics of personalized cultivation.

4. Standardize the professional curriculum system and form a reasonable knowledge structure. The talent training program formulated starts from the professional characteristics, pays attention to the knowledge structure of the six professional directions, takes the professional self-construction as the axis, and standardizes the professional curriculum system on the premise of paying attention to the interdiscipline.

![Core foundation courses](image-url)

**Figure 2. Eleven core foundation courses.**

**Reform and Innovation of Teaching Methods**

Reform and innovation of teaching methods for the innovative class are as follows:

1. Implementing small-class teaching. In order to train the students of the innovative class better, teachers adopt the method of small-class teaching;

2. Implementing a tutorial system. Every two or three students in the innovation class are provided with a teacher with a doctor’s degree or a senior professional title as the tutor. Tutors are determined by two-way selection between students and teachers. The tutor guides students according to their specialties and interests, instructs students to conduct scientific research training and research-based learning, and guides students to participate in various discipline competitions, and so on, with the focus on cultivating students’ innovative ability, innovative spirit and ability to solve practical engineering problems. In the “1.5” stage, the dual-tutor system is adopted to guide students by both internal and external tutors;
3. Implementing diversified teaching methods. In terms of teaching methods, teachers of innovative class have changed the traditional teaching mode and adopted such teaching methods as “flipped classroom,” “case teaching method,” and “group discussion method” to make students become the main body of learning and truly participate in teaching.

**Strengthen the Construction of the Teaching Staff**

Teachers are the fundamental guarantee for the cultivation of talents. The construction of the teaching staff is the core of innovative talent training. The cultivation of innovative talent ultimately depends on the first-line teachers, so the construction of the teaching staff should be in the core position. The construction of the teaching staff adopts the combination of introduction and training to build a “double-qualified” teaching team with high comprehensive quality, strong teaching and scientific research ability, adaptable to the training of engineering application-oriented talents, mastering the advanced education concept, engineering project development skills, and reasonable knowledge structure, which provides a strong guarantee for the construction of the innovative class. The specific measures are as follows:

1. One teacher has been trained as the leader of innovation class construction. The teacher in charge of the construction of the innovation class has been sent to a famous enterprise for more than half a year of training and internship, which enables him to update the concept of professional construction, improve the ability of professional technical service, and take charge of the implementation and completion of the talent training reform program.

2. Among the teachers of the college, more than three young teachers are selected and sent out every year for key training as “double-qualified” backbone teachers. They will be sent by stages and in groups to study for more than half a year in well-known universities in China, or practice for more than three months in leading enterprises both inside and outside of Guangdong province, to understand the latest requirements of enterprises for information technology (IT) graduates in terms of professional skills and comprehensive qualities. Meanwhile, they will also be sent to attend teacher training courses organized by our university or the Ministry of Education to broaden their horizons, renew their ideas, improve their practical ability and ability of technological research and development, and make them become the technical backbone of teaching reform and practice.

3. Part-time teachers. In the cooperative enterprise, two or three engineering and technical personnel or project managers with certain theoretical level and rich practical experience are employed as part-time teachers to conduct on-campus teaching of theory, practice, and off-campus on-the-job internship as well as guidance of students’ graduation design, etc. In addition, we employ senior technical personnel from enterprises to regularly exchange knowledge and skills in our university, and train part-time teachers in education theory, teaching methods and teacher professional norms, so as to improve the “double-qualified” of part-time teachers and ensure the teaching quality in practice. In order to stabilize the team of part-time teachers, we guarantee that part-time teachers enjoy the teaching and scientific research resources of the college and give priority to participating in the project application at all levels, and guarantee the funds and conditions.

**Strengthen the Practice Teaching Link**

Practical teaching is the main way to cultivate students’ practical ability. It has the same important status as theoretical teaching and is an indispensable and important link throughout the talent training system. It is not only a practical step to improve teaching quality, but also an important way to cultivate students’ practical
ability and innovative ability to attach great importance to and strengthen practical teaching links. After continuous exploration and accumulation, an innovation-oriented integrated practical teaching system has been established, which pays attention to the cultivation of practical ability and innovative ability. It mainly includes the following contents:

1. Systematic in-class practice. It mainly includes course experiments, cognition practice, course designs, course practices, graduation practice, and graduation thesis, etc. Through the optimization of these links, the practical links in class are integrated, and students’ practical ability is gradually improved, laying a foundation for the cultivation of students’ innovative practical ability.

2. Extracurricular practice of “integration of inside and outside school”. Our college has established both internal and external innovation practice bases for the innovation class. One professional laboratory of the college is transformed into an innovation and practice center, which serves as the main learning base and activity place of the “2.5” stage of the innovation class and provides a good environment and platform for students to carry out innovation and practice activities. We actively carry out school-enterprise cooperation, establish off-campus engineering practice base and research-oriented innovation practice base, which provide extracurricular practice platform for the innovation class students, and are the main learning place for students in the “1.5” stage.

3. Discipline competition and scientific research innovation activities: (a) IT culture festival. “IT culture festival” is a special project of our college. It has been held for nine consecutive sessions since 2010, and not only stimulates students’ interest in learning, but also greatly improves their practical and innovative abilities. “IT culture festival” sets up nine competition projects, including software design competition, Internet of things technology competition and network technology competition, and so on, to connect provincial and national competitions. Each student in the innovation class is directed by his/her tutor to participate in at least one of the competitions according to his/her specialty; (b) Innovative entrepreneurship projects for college students. To guide students to apply for all kinds of innovative and entrepreneurship projects for college students, and to carry out work in strict accordance with the procedures of project application, demonstration and evaluation, examination and approval, mid-term inspection, final application, final acceptance and other procedures, so that students can get preliminary training of scientific research ability; and (c) Adhering to scientific research to promote teaching, establishing a teacher-student innovation and scientific research team, so that students in the innovation class can accumulate project research and development experience and innovative practice ability.

Management Mode Reform

A leading group of the innovative class are set up, with the dean of the college as the group leader, the vice-dean in charge of teaching and the vice-secretary as the vice-group leader, a professional director with outstanding scientific research ability as the theory teaching director, a professional director with outstanding engineering practice ability as the practice teaching director, and a responsible counselor as the student work director, to provide guarantee for the work of the innovation class. The innovation class adheres to high standards, strict requirements, and the implementation of dynamic management and elimination mechanism. Considering the difference between the talent training programs of the innovation class and the ordinary class, students in the innovative class can only be eliminated without adding new members. Students in the innovation class will be disqualified, quit the innovation class, and return to the ordinary professional class of
the same grade if one of the following situations occurs:

(a) More than one (including one) course failed in one academic year;
(b) More than five courses (including five courses) with less than seventy points in one academic year;
(c) Failure to pass College English Test (CET)-4 in Grade two;
(d) Be punished by the school or college for violation of discipline.

If the students are eliminated from the innovation class, they will enter the corresponding ordinary class to study. If the courses they pass the examination are the same as those of ordinary class, the credits of the courses can be counted. If they are different, the leading group of the innovation class shall determine the replaceable courses.

Conclusion

After a round of training of the innovation class, a relatively stable talent training model has been formed. The whole class has formed a good team spirit and an atmosphere of scientific and technological innovation. The members of the class have participated in many academic competitions and scientific and technological training projects, and achieved a lot of achievements. In terms of class collective honor, the innovation class of 2013 won the “2014-2015 Advanced Class Collective” and the first “2015-2016 Top Ten Class Collective” of our university. In terms of individual honors, the students have achieved many achievements and won a lot of honorary titles. For example, students in the innovation class have won six first prizes and 18 second and third prizes in China education robot competition, Guangdong robot relay competition, Guangdong innovation and entrepreneurship challenge competition, and so on. They have won one special fund project (climbing plan) of scientific and technological innovation cultivation for college students in Guangdong Province, two national innovation and entrepreneurship projects for college students, two provincial innovation and entrepreneurship projects for college students, and one university-level innovation and entrepreneurship project. In addition, students in this class have won many honorable titles, such as national encouragement scholarship, merit student and outstanding member of the communist youth league, and so on. Although some achievements have been made, there are still some deficiencies that need to be addressed in the next step. For example, to provide more high-quality cooperative enterprises for students to choose in the “1.5” stage, to adjust the “1.5” stage more reasonably according to students’ situation, and to manage and monitor the “1.5” stage more effectively.

References


