

Research on the Cultivation of Innovative Talents in Application-Oriented Universities

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Abstract—With the rapid development of higher education, the number of various majors in colleges and universities is increasing, and the employment pressure of students is also increasing. Therefore, it is increasingly important to build a reasonable and practical innovative talent training model for college majors. In view of the current shortage of talent training in undergraduate application-oriented colleges, this paper explores the innovative talent training mode from the aspects of innovative talent teacher team construction, curriculum construction, school enterprise cooperation education, laboratory and practice base construction, innovation and entrepreneurship education, etc.

Index Terms—Application type, cultivation, explore, innovative

I. INTRODUCTION

The cultivation of innovative talents in colleges and universities should, according to the development needs of the country and regions, plan an innovation driven development strategy, gather superior resources, tap disciplinary and professional characteristics, cultivate application-oriented talents, promote the transformation of colleges and universities into application-oriented ones, and build a high-level application-oriented university. In the process of building an application-oriented university, we should develop a multi-specialty transformation to an application-oriented one according to the nature and characteristics of the university, disciplines and specialties, and carry out a multi-directional construction. However, due to the late start and exploration of applied majors, the training mode still has the following deficiencies:

1. Single access to knowledge

Classroom teaching, as a mainstream and important way to impart knowledge, still plays an important role in undergraduate education. However, a single classroom teaching method has some problems, such as a single source of knowledge, insufficient information interaction between teachers and students, one-way progressive learning mode, which is not conducive to cycle. In recent years, online learning mode based on network has developed, but it has not yet matured.

2. Practice teaching lacks systematic design

Undergraduate practical teaching is usually completed by setting in class experiments or practical courses. However, such application practice is relatively isolated and discrete, limited to a few knowledge points or a few courses, and lacks systematic practical teaching design. Only by designing the practice teaching system from the top to the bottom from the perspective of the overall layout of the specialty, can students truly integrate and flexibly apply knowledge and improve their understanding of the practice process.

3. Innovation education is obviously insufficient

In the process of the construction of application-oriented undergraduate courses, new technologies and new achievements continue to emerge, and the phenomenon of interdisciplinary integration of disciplines and specialties is becoming increasingly prominent. Therefore, the development of innovative education is very important. But the current innovative education has the following problems: First, the weight of undergraduate education is obviously insufficient; Second, the "quality" and "quantity" of free innovation and entrepreneurship activities after class are not enough, and the integration and combination of innovative courses and original courses are lacking, as well as the effective guidance of teachers in extracurricular activities and scientific research activities.

The following illustrates the characteristics of applied universities from the experience of international high-level applied universities.

II. EXPERIENCE IN RUNNING AN INTERNATIONAL APPLICATION-ORIENTED UNIVERSITY

Since the establishment of the University of Bologna in 1088, the University has experienced more than 900 years of development. Universities have gradually developed from medieval universities and Renaissance universities (humanistic reform) to modern universities. Under the influence of the industrial revolution, modern universities changed their functions and objectives, and brought science into the education system, laying the foundation for modern universities and modern higher education. Before the middle of the 19th century, modern universities belonged to elite education. The groups receiving education were mainly the privileged and ruling classes with power and money. The content of education focused on cultivating people's minds and personalities. Since the middle of the 19th century, the proportion of the secondary and tertiary industries in the industrial structure has increased. The demand for workers in the labor market has shifted from workers who can operate machines mechanically to application-oriented technical talents who have both theoretical basis and practical ability. Higher education has entered the stage of popularization. In Europe, there are gradually applied technical universities represented by Germany and Switzerland and applied universities such as multidisciplinary technical universities in Britain. In 1976, Germany issued the General Outline Law of Higher Education, followed by a series of laws and policies issued by the Netherlands, Austria and other countries. Applied colleges and universities entered a new stage of vigorous development. Among the 424 higher education institutions in Germany in 2019 and 2020, the number of applied technology universities accounted for 213, far exceeding 107 traditional universities. In 2019, the number of graduates from traditional universities and application-oriented universities in Switzerland was roughly the same. Such application-oriented universities are characterized by the cultivation of application-oriented talents, school enterprise cooperation and integration of industry and education, and have made great contributions to promoting the cultivation of application-oriented talents, applied scientific research and regional economic construction.

III. CHARACTERISTICS OF APPLIED UNIVERSITY

The applied university has the following five characteristics:

1. Talent training objectives for application and service areas

The application-oriented university is oriented to practice and application, and trains application-oriented technical talents who give consideration to both theoretical knowledge and practical innovation ability. It usually cooperates closely and cooperates with enterprises in the region. The specialty construction of colleges and universities has distinctive regional characteristics and is an important engine for regional economic and technological development.



2. Talent training mode of strengthening practice and highlighting practice

The goal of talent training in colleges and universities needs to be implemented in all aspects of talent training. The most important is the formulation of talent training programs and the arrangement of curriculum and teaching content. In addition to the three main modules of basic courses, professional courses and graduation projects/papers, the teaching modules of application-oriented universities also set up practice links such as project practice and enterprise practice, and pay attention to students' ability to apply theory to practice. The proportion of credit and class hours allocated to practice courses and extracurricular practice hours is more than 50% of the total class hours. The undergraduate project topics are mainly carried out in combination with the actual problems of enterprises and industries.

3. A solid academic and professional teaching staff

On the basis of having a doctor's degree, professors of applied universities need to have rich practical experience, usually more than 5 years of enterprise work experience. Therefore, professors of the University of Applied Technology are good at applied research and transformation of technical achievements. At the same time, the enterprise contacts of professors in application-oriented universities also create unique convenient conditions for university enterprise cooperation, integration of production and teaching, student internship and graduate employment.

4. University enterprise talent training mode of deep cooperation and win-win cooperation

The deep integration of schools and enterprises is the only way to achieve the goal of training application-oriented talents. For example, the German government strongly supports the establishment of a long-term and stable cooperative relationship between universities and enterprises, provides legal protection for the cooperative relationship between German applied universities and enterprises, and establishes a funding project for the cooperation between applied universities and enterprises. In terms of teaching content, German application-oriented universities invite enterprise technicians to evaluate the teaching objectives and updated teaching content of new majors and put forward reasonable suggestions. Students go deep into enterprise posts and participate in the production and operation practice of enterprises. German enterprises actively participate in providing students with internship posts and graduation design projects. Through the mechanism of multi-party participation, cooperative operation and win-win realization, the university and enterprise form a mutually beneficial and long-term stable cooperation pattern.

5. University evaluation system focusing on diversity and guiding development

In order to promote the long-term strategic goal of diversified and differentiated development of colleges and universities, the European Commission has funded a multi-dimensional global university rating project, which contains a more comprehensive statistical evaluation index system for colleges and universities. Under this indicator system, research universities usually achieve outstanding results in teaching and learning, scientific research and

internationalization, while applied universities achieve outstanding results in the transformation of intellectual property achievements and regional services and cooperation. The multi-dimensional university evaluation method provides a new idea for university evaluation. [7] examined the development and refinement of possible mathematical models for the intellectual system of career guidance. Mathematical modeling of knowledge expression in the career guidance system, Combined method of eliminating uncertainties, Chris-Naylor method in the expert information system of career guidance, Shortliff and Buchanan model in the expert information system of career guidance and Dempster-Schafer in the expert information system of career guidance method has been studied. The algorithms of the above methods have been developed. The set of hypotheses in the expert system is the basic structure of the system that determines the set of possible decisions of the expert system. This set, which is crucial in decision-making, should be sufficiently complete to describe all the possible consequences of situations that arise in the subject area. Therefore, it is important to improve the mathematical models of the intellectual system of career guidance. [8] discussed that according to the observations in this paper, an existing mathematical model of banking capital dynamics should be tweaked. First-order ordinary differential equations with a "predator-pray" structure make up the model, and the indicators are competitive. Numerical realisations of the model are required to account for three distinct sets of initial parameter values. It is demonstrated that a wide range of banking capital dynamics can be produced by altering the starting parameters. One of the three options is selected, and the other two are eliminated. The model is generalized taking into account fractional derivatives of the bank indicators for time, reflecting the rate of their change. Based on numerical calculations, it is established that reduction of the order of derivatives from units leads to a delay of banking capital dynamics. It is shown, that the less the order of derivatives from the unit, the more delay of dynamics of indicators. In all analyzed variants indicators at large times reach their equilibrium values.

IV. RESEARCH ON THE TRAINING MODE OF INNOVATIVE TALENTS

The training goal of the innovative talents major is to cultivate correct values, master professional knowledge, basic theories and methods, be familiar with professional technology, understand and grasp objective laws, skillfully use modern information technology, cultivate good communication ability and innovative thinking mode, and become an application-oriented, compound and innovative talent with a global vision and complete knowledge system that meets the needs of social development. All kinds of undergraduate colleges and universities should formulate corresponding training programs according to their own characteristics and specialties, and actively adopt various methods to cultivate diversified and high-quality innovative talents. The following will focus on the training mode of innovative talents, focusing on five aspects: curriculum



construction, teacher team construction, innovation and entrepreneurship education, laboratory and practice base construction, and industry education integration and collaborative education.

1. Course construction

Curriculum is an important support for the talent training system, and innovation ability comes from solid basic knowledge and good quality. It is far from enough for students to only obtain specialized knowledge. We should also strengthen the connotation renewal and extension expansion of students' basic education and professional education. Therefore, it is particularly important to establish a reasonable curriculum system. The curriculum construction can be carried out from the following aspects: the adjustment of professional curriculum system, the construction of high-quality courses, the promotion of professional curriculum teaching reform with teaching and research projects as the starting point, and the construction of teaching materials. The construction of laboratory and practice base is carried out from two aspects: software and hardware update and practice base. Innovation and entrepreneurship education is carried out from two aspects: adjusting the talent training program and supporting and guiding students to participate in innovation and entrepreneurship.

Adhere to the curriculum construction as a basic project to improve the quality of professors and schools, and attach importance to the establishment of three major curriculum platforms: general education curriculum, basic discipline curriculum and professional curriculum. The infiltration of liberal arts and sciences provides some natural science courses for liberal arts students, expands students' mathematical knowledge, college physics knowledge, basic computer application knowledge, etc., and tailors professional introductory courses to adjust professional direction. Include subject competition into quality development credits. Build quality courses, demonstration courses and bilingual courses. Relying on the teaching and research projects, we will carry out the construction of digital high-quality teaching resources, such as Moose classes and flipped classes, organize curriculum assessment reform, and implement the separation of teaching and examination or process assessment. Relying on the teaching reform project, we will continue to promote teaching discussion, and adopt various forms of teaching reform, such as entrepreneurs into the classroom, situational simulation teaching, and the use of networked and information-based teaching methods.

The construction of teaching materials is an important basic work to cultivate composite and application-oriented talents. In order to meet the requirements of the teaching reform and development of application-oriented universities, teachers should follow the frontiers of disciplines, and edit and participate in the compilation of a number of theoretical textbooks, practical training textbooks and teaching aids with distinctive characteristics, good quality, and extensive applications to meet the needs of high-quality innovative talents.

2. Faculty building

The training process of application-oriented talents must attach importance to practicality, which requires teachers in

application-oriented universities not only to have profound professional theoretical knowledge, but also to have rich practical experience and application skills. To this end, we can carry out teacher building from four aspects: internal training, external introduction, adjustment of teacher team layout according to industry reform, and cross professional integration, especially the training of dual ability teachers. Dual ability teachers refer to teachers who have teaching ability and the ability to cooperate with production, teaching and research, that is, teachers have the ability to be competent for professional theory teaching and professional practice teaching. To this end, the school can take a variety of measures, such as encouraging teachers to participate in the cooperation between production, teaching and research, hiring teachers with company experience to teach, sending young teachers to the company or relevant government departments to take temporary posts, etc. At the same time, the school can also set up the certification standard for dual ability teachers, formulate and implement the special plan for improving teachers' ability, and use multiple ways to promote the growth of dual ability teachers.

3. Innovation and entrepreneurship education

Innovation and entrepreneurship education is a basic way to cultivate innovation and entrepreneurship talents and inject innovation vitality into social and economic development. To this end, the first is to increase innovation and entrepreneurship courses and constantly improve the innovation and entrepreneurship education curriculum system. Establish an innovation and entrepreneurship training center, select teachers with certain experience, and gradually carry out education in the way of popularizing innovation and entrepreneurship awareness, innovation and entrepreneurship basic knowledge education, innovation and entrepreneurship practice education, and innovation and entrepreneurship tutor consultants. The second is to carry out innovation and entrepreneurship education and research by encouraging the application of college students' innovation and entrepreneurship projects. Professional tutors and relevant innovation and entrepreneurship teachers guide the formation of college students' teams, and apply for provincial and national college students' innovation and entrepreneurship projects. The student teams and tutors jointly implement the project and apply it to the society, so as to achieve the integration of scientific research, teaching and practice; third, gradually form the "one body, two wings" innovation and entrepreneurship education model. The Innovation and Entrepreneurship Training Center has been upgraded to the School's School of Entrepreneurship. Innovation and entrepreneurship education is embodied in taking the School of Entrepreneurship as the main body (that is, "one body") and taking general coverage and point breakthrough as the "two wings". Through offering entrepreneurship education courses, holding various innovation and entrepreneurship competitions, entrepreneurship salons, entrepreneurship practices and other activities to "cover the whole", further strengthen students' innovation and entrepreneurship awareness; Make a "breakthrough" for those students who have outstanding performance, and further improve the success rate of



students' innovation and entrepreneurship through the professional guidance of the school's entrepreneurship tutor team, the active incubation of college students' innovation and entrepreneurship projects, and the strong support of special funds.

4. Construction of laboratory and practice base

As an important means to improve students' skills, practical training courses and practice links are very important for training application-oriented innovative talents. Only by making effective use of the training room in the school and the practice base outside the school can we cultivate qualified application-oriented talents. To this end, first, by equipping with application software, computer hardware and other equipment, building laboratories, training bases, etc., to provide conditions for the training of high-quality application-oriented innovative talents; The second is to sign an internship base agreement with enterprises, use or share off campus internship bases, and provide strong support for practical activities such as post placement internship for graduates.

5. Cooperative education of schools, enterprises, places and schools

The fundamental task of an application-oriented university is to cultivate high-quality, innovative and application-oriented undergraduate talents for the frontline of production, management and service, which requires that the talent training model must be combined with the industry and enterprises, and with the needs of economic and social development. The collaborative education mode of school local cooperation, school school cooperation, and school enterprise cooperation in production and education integration is the way to realize the self-development of application-oriented universities and serve the local economic development. To this end, we should actively explore a diversified mode of school enterprise cooperation and collaborative education based on professional characteristics, strengthen the collaborative innovation ability of schools and enterprises through the signing of cooperation agreements, give play to their respective advantages, further integrate and optimize resources, release the vitality of talents, science and technology and other innovative elements, and achieve cooperative development, innovation and win-win results. In order to better learn and learn from the school running experience, schools can conduct exchanges in talent training, curriculum construction, innovation and entrepreneurship, academic exchanges, etc., establish production, teaching and research cooperation with enterprises, enterprises provide internship bases, equipment and raw materials, and participate in the formulation and implementation of the school's teaching plan. The school employs excellent managers or technicians of enterprises to guide students in practical training and internship. At the same time, the school sends excellent teachers to the enterprise to participate in production, scientific research and training staff. Through school enterprise cooperation, enterprises can acquire talents, students can acquire skills, and schools can develop,

achieving a win-win result of "complementary advantages, resource sharing, mutual benefit and common development" between schools and enterprises.

V. CONCLUSION

Bringing application-oriented colleges and universities into the higher education system is an important measure of higher education reform. We can learn from the experience of other colleges and universities and combine local actual conditions to break the cognitive framework and deepen the transformation and development of application-oriented. At the same time, adhere to the concept of application-oriented talent training, strengthen characteristics, highlight practice, focus on innovation, improve teaching quality monitoring, strengthen industry university research cooperation, and effectively improve service capabilities and talent training quality.

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