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The exploration and research of college students' innovation and entrepreneurship practice education mode under the background of new engineering-Take robotics engineering as an example

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Abstract: *In view of the problems that the current innovation and entrepreneurship teaching of college students is mainly theoretical, lacks a complete practical teaching system, and does not pay attention to the cultivation of students' practical ability, this paper proposes an innovation and entrepreneurship practice education system that is guided by the cultivation of practical ability, combined with discipline competitions, school-enterprise cooperation, etc., by optimizing the practical teaching content of the curriculum and integrating ideological and political elements. Through practice, it has been proved that the education model of innovation and entrepreneurship practice proposed in this paper can enhance students' enthusiasm for innovation and entrepreneurship practice and improve students' ability to analyze and solve problems.*

Keywords: *new engineering, innovation and entrepreneurship, practice, robot*

1. Introduction

Under the situation of vigorous development of the new economy, colleges and universities are faced with the difficulty of how to cultivate technical talents with stronger innovative thinking and innovative practice ability in the construction of the background of "new engineering".

This paper takes the robotics engineering major of Changshu Institute of Technology as an example to construct a new system of collaborative education and innovation practice in robotics in line with the background of new engineering, and form an innovative practice ecosystem that meets the needs [1-2].

2. The Construction of an Innovation and Entrepreneurship Practice Education System

As a newly opened undergraduate major, robotics engineering has not yet formed a perfect practical education system, and most colleges and universities still adopt the traditional model, and the talents trained cannot meet the needs of the society; In the context of new engineering, robotics engineering, as a new major, needs to adapt to the strategic development of the country, seek effective practical education methods, and establish a perfect practical education training system.

3. Measures for the Construction of a Platform for the Practice of Innovation and Entrepreneurship Practice Education

In the context of new engineering, how to formulate a practical curriculum system and build an innovative practice platform that meets the requirements according to the professional training objectives, so as to cultivate robot entrepreneurial talents with certain innovation and entrepreneurship practice

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ability.

3.1 Practical Guidance on Innovative Theoretical Methods

At present, the enthusiasm for innovation and entrepreneurship education in applied universities is very high, but due to the influence of traditional inertial thinking, innovation theory and methods are not introduced into the curriculum, which makes innovation practice lack theoretical guidance, resulting in innovation practice. It is difficult to achieve the expected results.

This paper organically combines TRIZ theory with innovation practice, applies the methods and tools of innovation theory to the practice teaching of innovation and entrepreneurship, and develops a new model of innovation practice ability training for application-oriented undergraduate universities. Cultivate students' ability to think creatively and improve their ability to practice innovation.

3.2 The Integration of Ideological and Political Elements in the Practice of Innovation and Entrepreneurship

Today, the main force of college students in China is the "post-00", with very distinct personality characteristics, strong self-awareness, and more diversified ideological values.

Ideological and political elements are integrated into practice, and students are encouraged to participate in the "Youth Red Dream Building Journey" track. Students can combine their own strengths and professional skills, tap potential advantages according to the characteristics of poverty-stricken areas, and choose appropriate innovation and entrepreneurship projects to serve the local economy and increase farmers' income. In the process of implementing the project, the education of socialist core values can be introduced, the patriotic education that promotes the Chinese dream, so that students can understand the current situation of society, understand China's national conditions, and the changing situation of the world, establish the awareness of serving the motherland and the society, and make due contributions to college students and assume social responsibilities in order to improve the living standards of poor areas .

3.3 Innovation and Rntrepreneurship Practice Education with the Integration of Industry and Education

The combination of the integration of industry and education lies in whether the students trained by colleges and universities and the students obtained by enterprises have the ability to innovate and practice.

In the context of the integration of industry and education, colleges and universities can integrate the cutting-edge technological achievements of the industry into the system of innovation and entrepreneurship practice education with the help of efficient information means, and continuously improve students' awareness of innovation and entrepreneurship through intensive training of students' thinking methods, so as to create a practical education model for innovation and entrepreneurship talents with the main link[3-5].

4. Practical Teaching Reform of Innovation and Entrepreneurship Practice Education

The robotics engineering major of our school is based on the practical education program of the trinity of "in-class-school-society", as shown in Figure 1. Combined with the innovation and entrepreneurship practice platform, a set of practice-oriented innovation and entrepreneurship practice education system has been established through the basic courses of innovation and entrepreneurship practice (stimulation of innovation consciousness), the integration of competition and education (innovation and entrepreneurship skills training), and the integration of industry and education (cultivation of innovation and entrepreneurship projects) .

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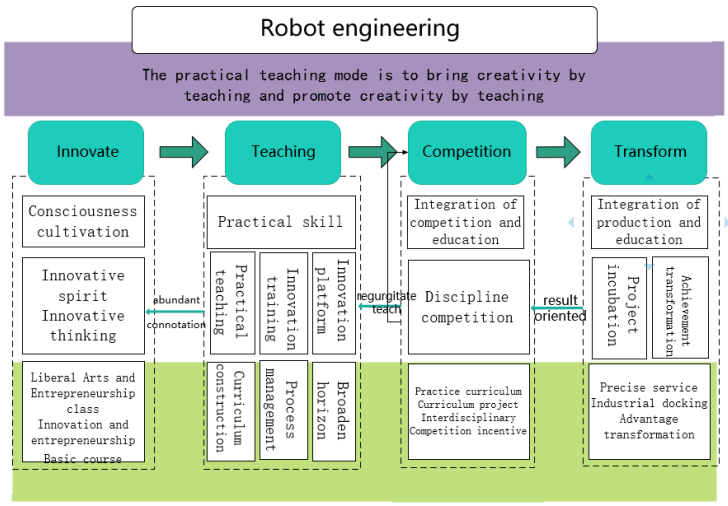

Figure 1: Practical teaching mode of robotics engineering

4.1 Vigorously Reform the Curriculum Teaching System, and Form a Teaching Model that Leads to Innovation Through Teaching and Promotes Innovation Through Teaching

In the process of practical teaching, students are guided to carry out innovation and entrepreneurship activities to serve local social and economic development; At the same time, guided by the needs of social development, we will continue to enrich and improve the practical teaching links.

4.2 Vigorously Develop Discipline Competitions, Adjust Training Ideas, and Realize that Entrepreneurship and Innovation and Competition Go Hand in Hand

Discipline competition is an important way to cultivate students' sense of innovation and improve their ability to innovate. By participating in various competitions, college students can improve their exploration ability, research ability and innovation ability in all aspects, and achieve a high degree of interdisciplinary and professional integration.

4.3 Deepen School-enterprise Cooperation and Promote the In-depth Integration of Schools and Enterprises

Enterprises are the main body of the market, and the school will take the achievements of "entrepreneurship and entrepreneurship" into economic benefits and better serve the society, which is an effective way to promote the long-term promotion of innovation and entrepreneurship practice teaching. The emergence of entrepreneurship parks across the country has provided an "incubation" base for the achievements of "entrepreneurship and entrepreneurship" education to go to the society, guided the achievements of entrepreneurship to "go global", and continuously improved the whole process of innovation and entrepreneurship practice education.

5. The Construction of Innovation and Entrepreneurship Practice Education Practice Platform and the Establishment of Cooperation Mechanism

5.1 Construction of Practice Platforms

5.1.1 School-enterprise Practice Platform

Combined with the characteristics of local industries, the robotics engineering major actively carries out industry-university-research cooperation education with enterprises to strengthen the cultivation of students' innovative and practical ability. At present, Fanuc Robotics Laboratory, ABB Robot Production Line Integration Laboratory, B&R EC Laboratory, Changshu Institute of Technology and Mitsubishi Electric Automation (China) Co., Ltd., Siemens (China) Co., Ltd., Wuxi Xinjie Electric Co., Ltd. and other well-known enterprises have established Fanuc Robotics Laboratory, ABB Robot Production Line Integration Laboratory, B&R EC Laboratory, Changshu Institute of Technology and

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Mitsubishi Electric Industrial Control Virtual and Real Combination Simulation Demonstration Base, Intelligent Logistics Robot Engineering Training Center, Intelligent Motion Control Experimental Center and Robot Operating System (ROS) Joint Training Base.

5.1.2 Discipline Competition Platform

The college attaches great importance to the integration of competition and education, and has built a school-level discipline competition platform intelligent vehicle & robot competition innovative talent training base, with a total area of about 2,000 square meters. The main competitions are: China Robot Competition, Rui Kang Robot Developer Competition, China University Intelligent Robot Creative Competition, China Robot and Artificial Intelligence Competition and other ranking events. In the past three years, the students of the base have won 15 championships, 53 national awards, 74 provincial awards, 12 patents, 20 published papers, 97 innovative training projects for college students at all levels, 7 scientific research projects, and 5 self-made teaching experimental instruments and equipment.

5.1.3 Science and Technology Service Platform

The institute has established an intelligent manufacturing technology research center, which consists of an intelligent robot equipment application research center, an intelligent detection and equipment research center, an industrial control virtual and real simulation research center, and an industrial digital management and control research center. It provides a practical platform for students to understand the social needs and technical difficulties of the robot industry.

5.2 Establishment of cooperation mechanisms

1) Establish the "Robotics and Machine Vision Technology School-Enterprise Cooperation Education Alliance" to build an educational community, as shown in Figure 2. The school-enterprise cooperative education alliance has set up a school-enterprise cooperation management committee, which is jointly composed of both schools and enterprises to jointly determine the training goals of professional talents, formulate training programs and curriculum competency arrays, build innovative practice platforms, and jointly form teachers. According to the needs of enterprises, the school-enterprise cooperative education alliance selects some students to try out "order-based" talent training, and sets up professional enterprise course modules according to the needs of enterprises, so as to cultivate talents for enterprises in a targeted manner.

2) School-enterprise cooperative teaching to realize the exchange and integration of school and enterprise resources. Colleges and universities hire enterprise engineers as visiting professors or course lecturers; According to the needs of the company's job ability, the enterprise course (industry-education integration course) and the comprehensive innovation practice training program are set up, and the integrated curriculum system and teaching content including the enterprise course module are reconstructed; Coordinate the high-quality resources of school-enterprise venues, equipment, and facilities, jointly build a collaborative practical training platform inside and outside the school, implement the "dual tutor system" teaching, and implement teaching activities such as enterprise internships and graduation projects.

3) Adopt the "N+1+N" collaborative education mechanism of N industry technology-leading enterprises + schools + N industry application enterprises. Industry technology-leading enterprises mainly build a curriculum system and an on-campus engineering practice education center with schools, and industry application enterprises mainly build off-campus engineering practice education bases with schools, which are the main undertakers of students' production practice, graduation design and employment[6-7].

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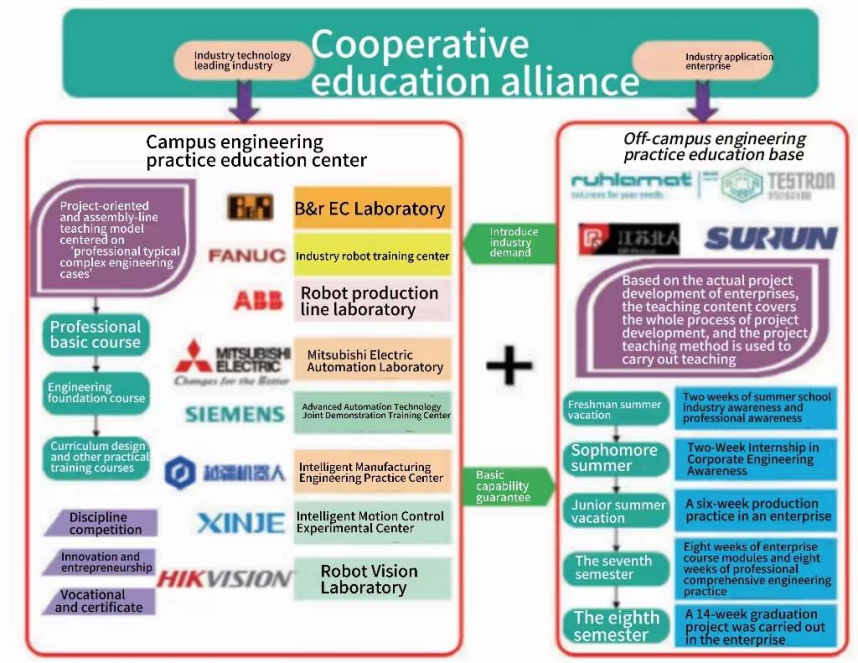

Figure 2: Robotics Engineering School-Enterprise Cooperative Education Alliance

6. The Implementation Process of Innovation and Entrepreneurship Practice Education

This course system focuses on the practical teaching of robots, which involves many disciplines, such as robot mechanical structure, robot control technology, intelligent control algorithms, visual image processing, etc., through different practical teaching methods, to obtain practical engineering experience, master product creativity, product design, product realization and transformation in the field of robotics and other related knowledge and processes, and be familiar with the basic knowledge of innovation and entrepreneurship practice and enterprise management mode , as shown in Figure 3

Students first learn the theoretical knowledge in the classroom, and then enter the practical link of innovation and entrepreneurship, through the investigation of the market in related fields and the product production process of enterprises, explore the needs of enterprises or the pain points of the current industry, and determine the topics of innovation practice through refinement. The whole practice process is designed and developed with students as the main body, and external tutors assume the role of guidance. According to the actual needs of the project, students can conduct project analysis, formulate technical routes, development progress, team division of labor, etc. In previous years, enterprises selected topics such as auto parts inspection systems, recognition equipment based on machine vision, and agricultural picking robots. In the process of practice, students are familiar with the financial knowledge and project management of product development through online and offline communication and guidance, flexible and diverse innovative practice methods, and the exploration of students' independent practice methods, and through project cost analysis and business plan writing .

In the course of the project, ideological and political elements are integrated into all aspects of practical teaching, which promotes the all-round development of students' innovative theories, innovative practical abilities, and professional qualities.

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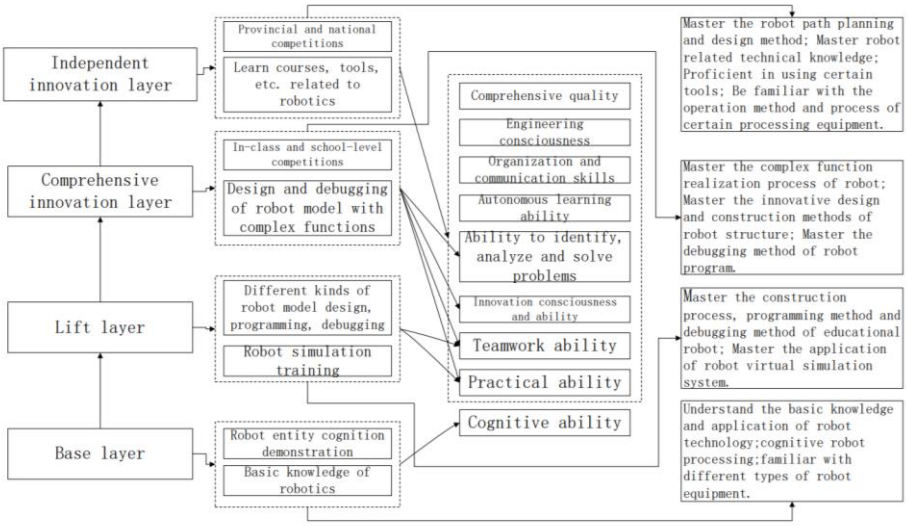

Figure 3: Practical Education System of Robotics Engineering

7. The Reform Effect of Innovation and Entrepreneurship Practice Education

The university actively builds a talent training system in the context of new engineering, and incorporates discipline competitions as the core content into the innovation and entrepreneurship practice education system; 2022 National Robotics Competition Index for Colleges and Universities (Undergraduate) The 311 colleges and universities with robotics engineering majors will rank the schools with scores in the top 50% and list the ranking within the province, as shown in Figure 4.

Table 1 List of student competitions included in the 2022 edition of the Robotics Competition Index

Serial number	Title of competition	Serial number	Title of competition
1	"Siemens Cup" China Intelligent Manufacturing Challenge	14	World Robot Competition (added in 2022 edition)
2	RoboCom World Robot Developer Competition	15	Worldskills Competition
3	RoboCup RoboCup	16	Worldskills Competition China Trials
4	International Underwater Robot Competition	17	Dream Angel Cup International aerial robot competition
5	International Autonomous Intelligent Robot Competition (added in 2022 edition)	18	Chinese university robot creative competition
6	The national college student robot competition Robocon	19	China Engineering Robot & International Open (Added in 2022 edition)
7	The National College student robot competition RoboMaster	20	Chinese machine game competition
8	The national college student Robot competition RoboTac	21	China Robot Competition (RobCup RoboCup China)
9	National Underwater Robot Competition for college students	22	China Robotics and Artificial Intelligence Competition
10	National undergraduate underwater robot discipline competition	23	China Educational Robot Competition (added in 2022 edition)
11	National Robot Skills Competition (renamed International Youth Artificial Intelligence Competition)	24	China Graduate Robot Creative Competition (added in 2022 edition)
12	National 3D Digital Innovation Design Competition (Robot Competition)	25	China Intelligent Robot Fighting and Competition (added in 2022 edition)
13	National vocational college skills Competition		

Southeast University	Robot engineering	129	A+	1	Jiangsu Province
Changshu Institute of Technology	Robot engineering	158	A	2	Jiangsu Province
China University of Mining and Technology	Robot engineering	149	A	3	Jiangsu Province
Nanjing University of Science and Technology	Robot engineering	132	A	4	Jiangsu Province
Nanjing Institute of Technology	Robot engineering	129	A	5	Jiangsu Province
Nantong University	Robot engineering	127	A-	6	Jiangsu Province
Jiangsu University	Robot engineering	100	A-	7	Jiangsu Province
Nanjing University of Aeronautics and Astronautics	Robot engineering	72	A-	8	Jiangsu Province
Jinling Institute of Science and Technology	Robot engineering	116	A-	9	Jiangsu Province
Nanjing University of Posts and Telecommunications	Robot engineering	47	B+	10	Jiangsu Province

Figure 4: The list of university competitions and the ranking of our university in the Robotics Competition Index

The platform has achieved good results by incorporating the content of discipline competitions into the innovation practice system, providing financial guarantees and guiding the construction of the teaching team, some of the results are shown in Figure 5.

Figure 5: Robotics hands-on education outcomes

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8. Conclusions

Due to the long-term influence of examination-oriented education, there is a problem in innovation and entrepreneurship that is widespread at present: most of the innovation and entrepreneurship courses are mainly lectures, and students' independent thinking and practical education are neglected, which does not achieve the desired effect of innovation and entrepreneurship practical education. To solve these problems, it is necessary to change the concept of teaching and turn to a direction dominated by practical education models.

References

[1] Sun Mingxiao, Luan Tiantian, You Bo, et al. Analysis and Reflection of Robotics Engineering Professional Innovation Practice System in the Context of New Engineering [J]. Journal of Higher Education, 2022, 8(18):33-36+40.

[2] Zhang Yu, Yang Jiayue, Yi Xiangbin, et al. TRIZ Research and practice of integrating innovation methods into innovation and entrepreneurship education in applied universities[J].Comparative Study of Cultural Innovation,2020,4(10):135-136.

[3] Liu Jie,He Hong,Wang Ning. Practical research on the integration of ideological and political elements into the "343-style" college students' innovation and entrepreneurship education system[J]. Journal of Hubei Open Vocational College, 2022, 35(21):1-2+8.

[4] Li Yinqing, Li Heng,Liang Zhongyi. Research on the construction of innovation and entrepreneurship practice education system in applied colleges based on discipline competitions: A case study of Changchun University of Traditional Chinese Medicine[J].Vocational and Technical Education,2022,43(32):61-66.

[5] Bie Yutao, Xuan Yubo, Zhang Yunan, et al. Construction and application of intelligent robot curriculum system based on innovation and entrepreneurship education[J].China-Arab Science and Technology Forum,2021,(04):153-155.

[6] Cui Lanhua, Zheng Hongwei, Wang Wei, et al. Research and exploration of the teaching system of robot cognitive practice based on the cultivation of innovation ability[J].Research and Practice of Innovation and Entrepreneurship Theory,2023,6(14):78-81.

[7] Xu Rong, Liu Junjian. Research on the academic competition system integrating with professional education in the context of new engineering[J].Journal of Chongqing Jiaotong University(Social Sciences), 2020,20(05):91-97.