International Journal of Science and Engineering Applications
Volume 13-Issue 11, 01 – 05, 2024, ISSN:- 2319 - 7560
DOI: 10.7753/IJSEA1311.1001

Study and Practice of the Training Mode of Excellent Talents in Electronic Information Engineering in Local Universities Based on "Emerging Engineering" in China

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Abstract: In order to training excellent talents students, to deal with the problems which the curriculum system is lagging behind, the industry and education are out of touch, and the teaching methods are backward, "emerging engineering" research and practice projects of the Ministry of Education of china was carried out during last 6-7 years. We have built a new curriculum system with subject foundation courses, professional foundation courses and professional courses as the main axis and artificial intelligence and Internet of Things courses as the two wings. We have created a new mechanism of "multi-faceted and full-process" collaborative education, and innovated new teaching methods of "teaching education" and "anytime, anywhere" practice. We have achieved significant results in talent training, and this major was approved as a national first-class undergraduate major of China.

Keywords: outstanding engineering education; teaching reform; Java course; Electronics Information Engineering;

1. INTRODUCTION

Since the 18th CPC National Congress, General Secretary Xi Jinping has repeatedly pointed out that in the next few decades, a new round of scientific and technological revolution and industrial transformation will form a historic intersection with China's accelerated transformation of economic development, and the role of engineering in society has undergone profound changes. Engineering science and technology progress and innovation have become an important engine for promoting the development of human society. This has brought great opportunities for innovation and reform of engineering education, but this opportunity is no longer a traditional opportunity to simply expand the scale and increase the number of majors, but a new opportunity that forces us to reflect on engineering education and build "new engineering"[1]. It is worth further studying how to achieve the transformation from concept to action in the construction of new engineering disciplines by transforming platforms in the higher education system and engineering education process[2].

The fourth industrial revolution has led to the rapid development of the electronic information industry, but the relevant majors in colleges and universities are still using outdated curriculum systems, education mechanisms and teaching methods to cultivate talents, resulting in a serious disconnection between colleges and universities and the industry and society, and an urgent need for emerging engineering reforms[3-4].

As an engineering major in a local university, the undergraduate major of electronic information engineering at Yangtze University aims to cultivate compound and application-oriented senior engineering and technical talents for the industry and the local area, and plays a supporting role in regional economic development and industrial transformation and upgrading[5-6].

Since 2013, the teaching team of this major has mainly carried out teaching research and practice based on projects such as the "Excellent Engineer Education and Training Program" of the Ministry of Education, using the National Experimental Teaching Demonstration Center for Electrical and Electronic Engineering as a platform; since 2017, the teaching team of this major has mainly carried out "new engineering" research and practice based on the first batch of "emerging engineering" research and practice projects of the Ministry of Education: “Reform and practice of multi-party collaborative education model for new engineering disciplines in local universities”. With the strong support of government departments and the active participation of social forces such as enterprises, after 6-7 years of exploration and practice, a model for cultivating outstanding talents in electronic information engineering in local universities based on "emerging engineering" has gradually been formed.

2. CURRICULUM SYSTEM OF “ONE AXIS AND TWO WINGS”

2.1 Reconstruction the Curriculum system

With the rapid development of new technologies, the original curriculum system has obviously failed to adapt to the new situation. In order to change this situation, on the one hand, the original courses are upgraded and renovated, outdated content is deleted, content reflecting new technologies is added, and basic knowledge is strengthened. On the other hand, new courses such as "Introduction to Artificial Intelligence" and "Internet of Things Technology" are added, thus building a new "one axis and two wings" curriculum system with subject basic courses, professional basic courses and professional courses as the main axis and artificial intelligence and Internet of Things courses as the two wings (shown in Figure 1).

2.2 Strengthen practical innovation and improve training programs

In order to meet the needs of emerging industries and the needs of students' all-round development, we adjusted the

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original three-tier theoretical curriculum system, sorted out and streamlined the core professional courses to free up hours and credits, added artificial intelligence courses such as "Introduction to Artificial Intelligence", "Machine Learning", "Computer Vision" and Internet of Things courses such as "Iot Technology", "Sensor and Acquisition Technology", and "Petroleum Internet of Things Engineering", and constructed a "one axis and two wings" curriculum system, forming a composite knowledge framework curriculum system with the original professional curriculum system as the main axis and artificial intelligence and Internet of Things courses as the two wings.

The practical teaching resources and engineering cases are updated; for the practical links of the new courses, through school-enterprise cooperation, new corresponding laboratories are built, and industry-oriented practical teaching resources and engineering cases are developed, so that practical teaching can keep pace with technological development and meet the innovation and development needs of enterprises. The “One axis and Two wings” curriculum system is shown in Figure 1.

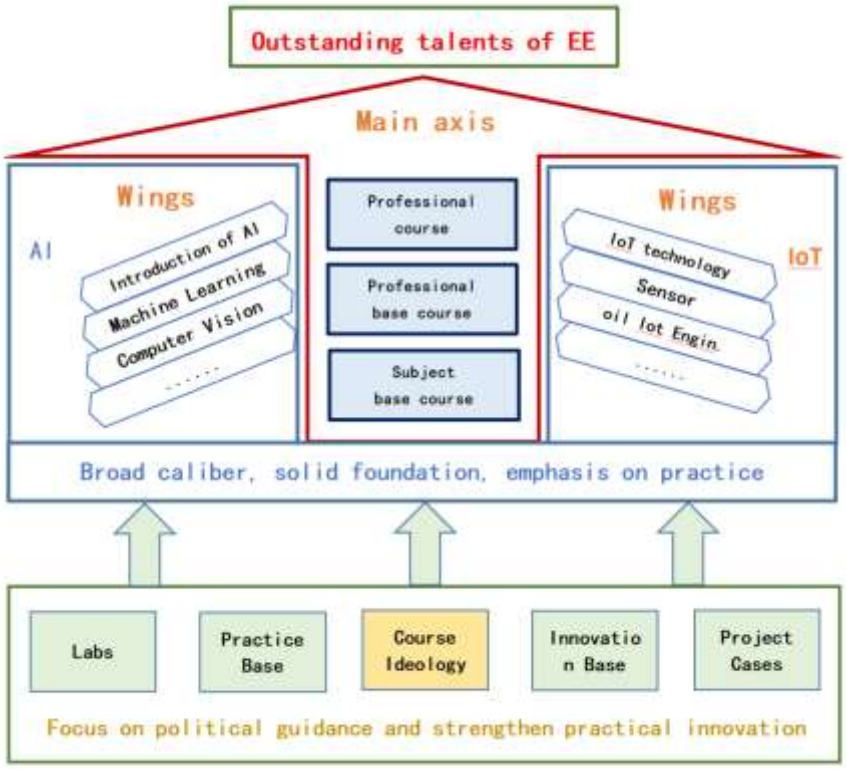

Figure 1. Curriculum system of “One axis and Two wings”.

3. NEW MECHANISM OF COLLABORATIVE EDUCATION

3.1 Building a new platform for collaborative education

With the strong support of government departments and the active participation of social forces such as enterprises, 18 multi-party collaborative education platforms such as the "Image Processing and Machine Vision Innovation Laboratory" were newly established based on the National Experimental Teaching Demonstration Center for Electrical and Electronic Engineering.

In 2018, it was approved by the Ministry of Education for the first batch of new engineering research and practice projects "Reform and Practice of Multi-party Collaborative Education Model of New Engineering in Local Universities", and in 2019, it was approved as a national first-class undergraduate professional construction site. In recent years, it has been approved by the Ministry of Education for 19 "Industry-University Cooperation, Collaborative Education" projects. In 2018, the Jingzhou Open Laboratory was listed by Yangtze University, including three open laboratory pilots: the Mechanical and Electrical Integration Innovation Center, the Internet of Things and Big Data Center, and the BIM Technology Center; in 2020, the China Association for Science and Technology Overseas Intelligence Opportunities Hubei (Jingzhou Development Zone) Working Base was established; in 2022, Sinopec Machinery, Jingzhou Municipal Government, and Yangtze University signed a contract to jointly build the Jingzhou Petroleum Science and Technology City.

It has jointly built six joint laboratories including the "Yangtze University-NI Software Radio Joint Laboratory" with NI Company of the United States; it has jointly built six internship and training bases with Danei Group, Aura International, Shenzhen Xunfang and other companies; it has jointly built three innovation bases including the embedded system maker space and the software maker space with Guangdong Yueqian; it has jointly built two virtual simulation laboratories including the "Big Data Remote Virtual Laboratory" and the "Communication Principle Virtual

Simulation Laboratory" with Beijing Pukai and Wuhan Lingte respectively.

3.2 Establish a new mechanism for collaborative education

Relying on the multi-party collaborative education platform inside and outside the school, through measures such as corporate mentors entering schools, university teachers entering enterprises, and combining student learning and practice between schools and enterprises, a new "multi-faceted" collaborative education mechanism has been established that benefits multiple parties including government, industry, academia, and research, and has a benign interaction. This has achieved "full-process" collaborative education in which multiple parties participate in talent training and run through all teaching links.

Give full play to the school's position as the main battlefield of education, and carry out all-round guidance with the participation of all staff: academic guidance by department leaders, ideological and political guidance and professional learning tutoring by teachers, psychological counseling by counselors, career guidance by corporate experts, safety supervision by class teachers, and political leadership by outstanding student cadres.

Collaborative education throughout the whole process.Visit enterprises in the freshman year. Take students to visit China Telecom Group Jingzhou Branch, Jingzhou Radio and Television Media Group and other enterprises in the freshman year to understand the actual production situation of the enterprises. Production internship in the sophomore year. In the sophomore year, they went to China Aerospace Science and Industry Corporation Aerospace Nanhu Electronic Information Technology Co., Ltd., Hubei Guangfa Communication Co., Ltd., Kaile Quantum Communication Technology Co., Ltd. and other enterprises for on-the-job internships. Enterprise courses are offered in the junior year. Cooperate with Wuhan Houpu Education Technology, Shenzhen Xunfang and other companies to offer enterprise courses such as "Industry Engineering Standards and Specifications" and "Digital TV Technology" and course designs such as "Software System Development and Implementation" and "Electronic Information New Technology Training". Graduation design in the senior year. Invite 3-5 enterprise experts to participate in the undergraduate graduation design teaching link every year, and guide more than 10 undergraduate graduation theses per year.

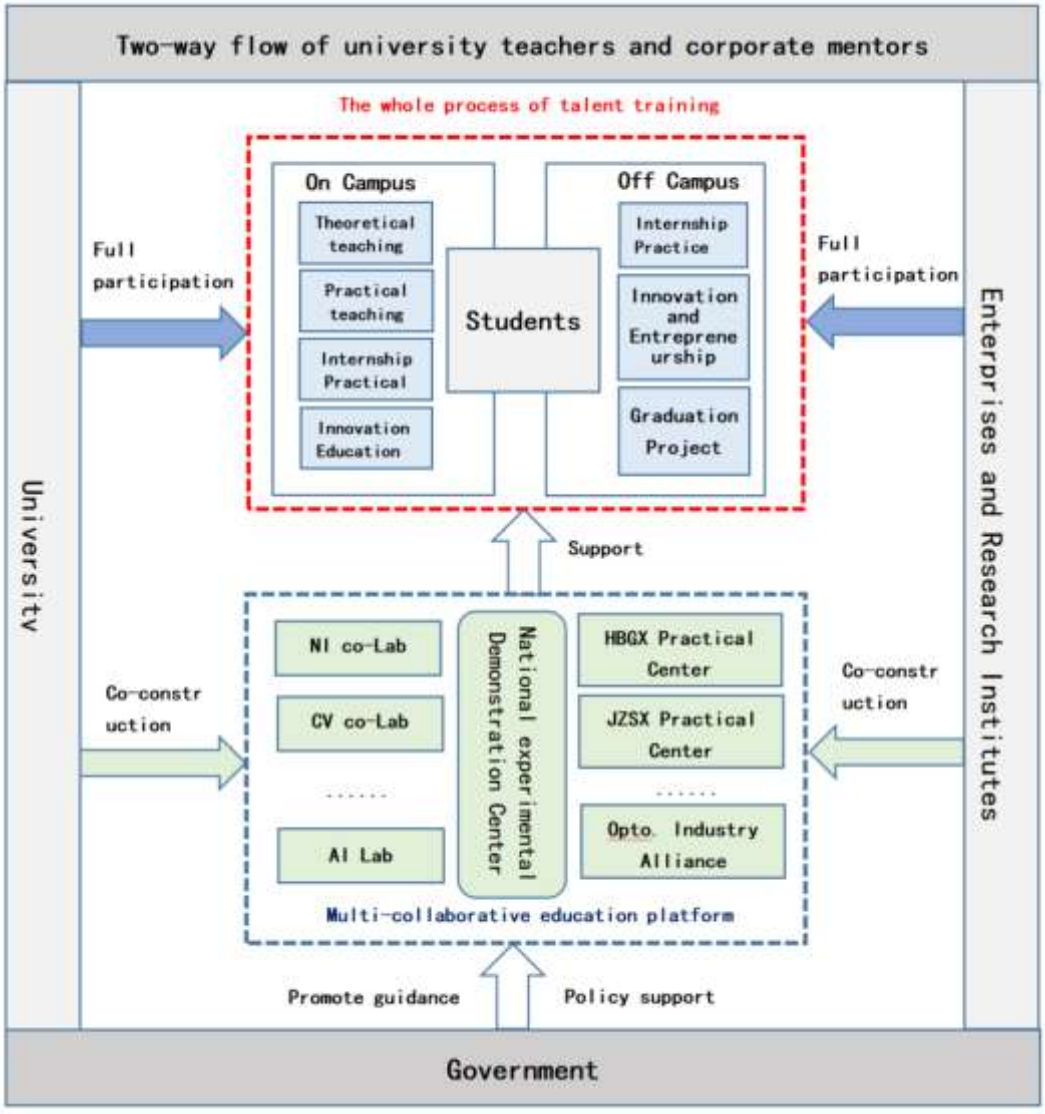

Figure 2. A new mechanism of "multi-faceted and full-process" collaborative education.

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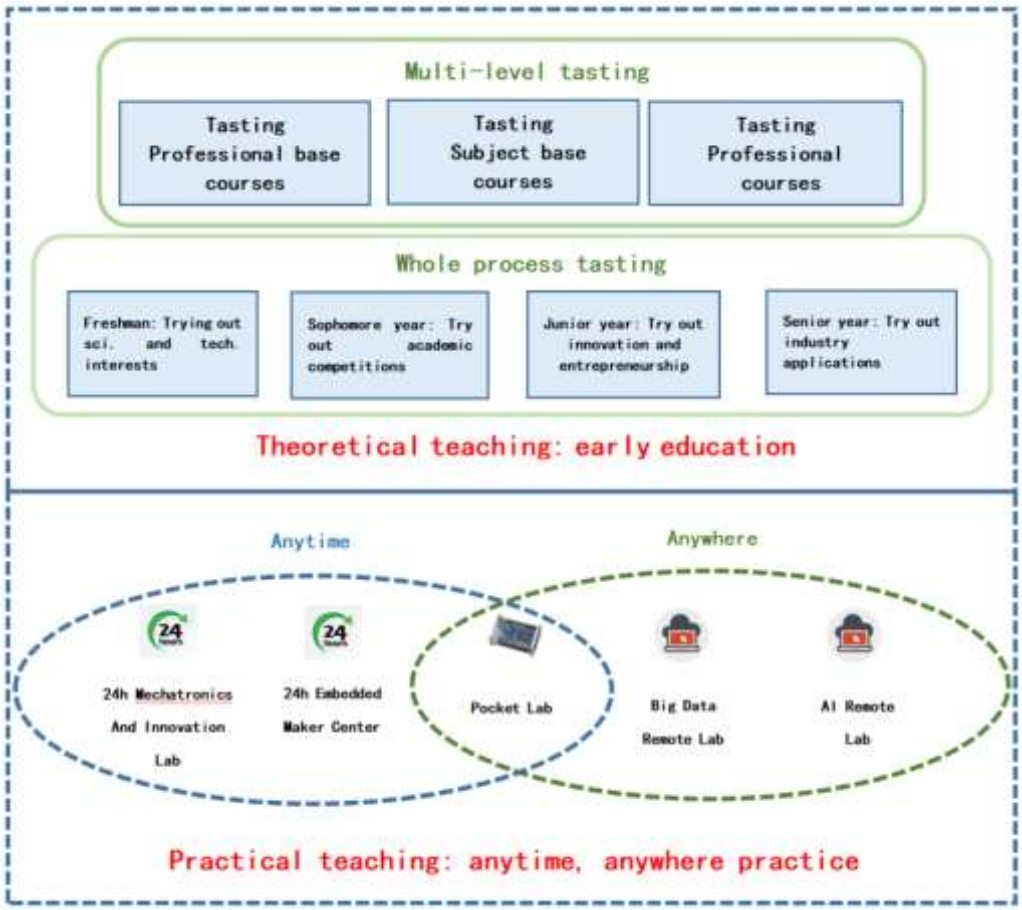

Figure 2. Innovative teaching methods of "teaching for the first time" and "anytime, anywhere" practice.

4. NEW METHODS OF PRACTICAL TEACHING

4.1 Create a new method of classroom teaching for "tasting education"

The school has created a new method of "teaching new things" by "first letting students taste something new, then taking various measures to guide them to explore cooking methods". In the four years of university, students are allowed to taste new things "throughout the whole process" by taking scientific research results, competition works, innovative entrepreneurial works, and the application of high-tech technologies such as artificial intelligence in the petroleum industry as examples; in the specific teaching process, the school carefully sets up "multi-level" tasting points in the basic courses, professional basic courses, and professional courses to continuously stimulate students' curiosity.

4.2 Implement a new "anytime, anywhere" practical teaching plan

Basic courses such as "Circuits" are moved forward to the freshman year, and other courses are moved forward accordingly. "Pocket laboratories" are introduced to encourage students to practice early. Full use is made of remote laboratories and 24-hour open laboratories in the national experimental teaching demonstration center and 18 collaborative education platforms inside and outside the school. Through school-enterprise collaboration, practical conditions that are not restricted by time and place are created throughout the four years of university, thus implementing a new plan for practical teaching "anytime, anywhere". Comprehensively utilize pocket laboratories (pocket laboratories refer to experimental equipment that is miniaturized, portable, and pocketable), 24-hour face recognition laboratories and maker centers, and cloud computing-based remote laboratories to cultivate students' practical skills throughout the process.

Pocket laboratories. In order to facilitate students to conduct experiments anytime and anywhere and start experiments as early as possible, we introduced pocket laboratories for courses such as "Basics of Circuit Analysis", "Analog Electronic Circuits", and "Digital Electronic Technology". They were distributed to students in their freshman year, so that students can combine MOOCs and other teaching resources to study and practice in advance.

24-hour open laboratory. We upgraded the face recognition management system for the National Electrical and Electronic Experimental Teaching Demonstration Center. Each laboratory has achieved unmanned operation and is open to teachers and students 24 hours a day.

Remote laboratory. The "Yangtze University-Pukai" big data joint laboratory and artificial intelligence laboratory have been established. These laboratories provide remote login functions.

Students and teachers can log in anywhere to complete various experiments, innovation and entrepreneurship training, and scientific research projects.

5. CONCLUSION

After 6-7 years of research and practice, Yangtze University's Electronic Information Engineering major was approved as a national first-class undergraduate major construction site. The number of students in this major who won awards in competitions increased by an average of 37.5%; the number of projects undertaken in the College Students Innovation and Entrepreneurship Training Program increased year by year, from an average of 13 to 25 per year; the number of SCI papers published increased from zero to eight; and the number of patents approved increased from zero to six. The student employment rate remained stable at over 98%, with over 60% of graduates employed in related industries and local grassroots frontlines; the quality of employment improved year by year, with an obvious increase in the average annual salary, and the highest annual salary for fresh graduates reached 160,000 yuan. The rate of admission to postgraduate schools increased from 30% to 56%, of which the rate of admission to 985/211 universities increased from 11% to 32%.

6. ACKNOWLEDGMENTS

The research is supported jointly by the Teaching researching project of Yangtze University (JY2020016), The Hubei Province Teaching Research Project (2020409).

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