Exploration of a new model for cultivating innovative talents in universities under the background of "new engineering & artificial intelligence"

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***Abstract*—In response to the evolving demands for innovative and entrepreneurial talents in the era of new engineering and artificial intelligence in Chinese society, after conducting a comprehensive analysis of the challenges currently faced by applied universities in the context of entrepreneurial education, it introduces a new model for nurturing innovative and entrepreneurial talents, coined as the "horizontal integration & vertical progression" model. It is driven by artificial intelligence technology and involves the revitalization of educational philosophies and innovative talent development strategies. It seamlessly integrates entrepreneurial education with specialized education, initiating a comprehensive reform in talent cultivation. In practical implementation, with the main force of reform, it is necessary to collaborate with strong related majors to carry out interdisciplinary and integrated training plans and curriculum system reforms, establish a "four dimensional integration" team of innovation and innovation mentors, and build a diversified innovation and training support platform. The implementation of the new model not only aids students better adapt to the needs of the new engineering and artificial intelligence era, but also promotes innovation in talent cultivation in applied universities, improves education quality, and enhances competitiveness.**

***Index Terms*—Innovation and entrepreneurship, New Engineering, Artificial intelligence, personnel training.**

I. INTRODUCTION

In the construction of new engineering disciplines, artificial intelligence is regarded as one of the core technologies and an important branch of this field. As a leader in the construction of new engineering disciplines, the cultivation of innovative talents in the field of artificial intelligence has risen to the height of national development strategy. In 2017, the State Council issued the "New Generation Artificial Intelligence Development Plan", which encouraged and promoted the cross-integration of artificial intelligence and related disciplines and professions, and broadened and integrated the content of artificial intelligence education on the basis of traditional majors. In 2018, the Ministry of Education proposed in the "Artificial Intelligence Innovation Action Plan for Higher Education" that it is necessary to accelerate the popularization, innovation and application of artificial intelligence in the field of education, actively utilize artificial intelligence technology to support the innovation talent cultivation mode of colleges and universities, reform teaching methods, and enhance educational governance capabilities[1]. In the context of "new engineering & artificial intelligence", innovation and entrepreneurship education has become indispensable. The core concept of innovation and entrepreneurship education is to cultivate students' innovative consciousness, entrepreneurial spirit and practical ability, so that they can transform their knowledge into creative solutions. This concept is closely aligned with the needs of the era of "new engineering & artificial intelligence". In recent years, innovation and entrepreneurship education has gradually become the core content of teaching philosophy reshaping and teaching system reform in various colleges and universities. Through cultivating students' innovative entrepreneurial thinking and practical skills, it can cope with the changes in the era of artificial intelligence, which has become an important task in the construction of new engineering disciplines in China[2].

However, the current talent training programs and curriculum systems of most application-oriented universities mainly focus on traditional professional knowledge architecture, with relatively scarce interdisciplinary curriculum systems and insufficient supply of innovative talents[3]. This situation is particularly prominent in the era of artificial intelligence. As a huge technological system, artificial intelligence covers knowledge in many fields such as machine learning, deep learning, human-computer interaction, natural language processing, and machine vision. How to effectively integrate this knowledge into the existing training system has become an urgent challenge. In addition, the demand for high-quality talents in the emerging digital, networked, and intelligent fields is growing, and traditional training models cannot meet these diverse needs. In order to cultivate more innovative and entrepreneurial talents that are more adaptable to the needs of the times, reform has become a top priority. The new talent training model requires a stronger emphasis on interdisciplinary collaboration, encouraging students to establish connections between different fields and achieve cross-border integration of knowledge. In addition, it is necessary to place the cultivation of students' practical ability in the first place, and through project practice, curriculum experiments, etc., students can truly apply what they have learned to solve practical problems. Innovation and entrepreneurship education should also become part of the training model, cultivating students' innovative thinking and entrepreneurial abilities, and laying a solid foundation for their future careers. This series of reforms requires the redesign of educational content and methods to provide students with a more diversified and comprehensive learning experience. The following in-depth discussion and research on the construction and implementation of a new model of talent training for innovation and entrepreneurship in application-oriented universities aims to provide a talent training program that can adapt to the needs of the new engineering

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and artificial intelligence era.

II. PROBLEMS IN THE APPLICATION-ORIENTED COLLEGE INNOVATION AND ENTREPRENEURSHIP EDUCATION UNDER THE BACKGROUND OF "NEW ENGINEERING & ARTIFICIAL INTELLIGENCE"

Since the Ministry of Education issued the "Opinions on Vigorously Promoting Innovation and Entrepreneurship Education and College Students' Self-employment", the innovation and entrepreneurship education in colleges and universities has entered a period of comprehensive promotion, and the innovation and entrepreneurship education in colleges and universities in China has shown a trend of government-led, college participation, and top-down direction[4].

At present, most application-oriented colleges and universities have integrated "entrepreneurship and innovation" courses into talent training programs, and set up innovation and entrepreneurship guidance centers. They attach great importance to various innovation and entrepreneurship competitions such as "Internet plus Undergraduate Innovation and Entrepreneurship Competition", "Undergraduate Innovation and Entrepreneurship Training Program" and "Challenge Cup", and have achieved certain results However, with the rapid development of AI technology, mass entrepreneurship and innovation education is facing some urgent problems in terms of educational philosophy, teacher resources, curriculum design, and practice platforms.

A. Outdated educational concepts

At the school level, the goal of cultivating innovative and entrepreneurial talents is only focused on application-oriented talents, and the educational concept remains in the traditional cognition of "specialization in one's field of expertise", ignoring the fact that new engineering talents in the new era of artificial intelligence should be comprehensive, with the characteristics of "cross-disciplinary integration of disciplines and majors". In addition to being able to use professional knowledge to solve problems in their own field, they also have the ability to integrate artificial intelligence technology to solve problems in cross-cutting industries in the future. The outdated educational concept has led to slow progress in the reform of innovative and entrepreneurial education. At the student level, due to the influence of traditional majors, most students have a shallow understanding of the development of new engineering and artificial intelligence. During their school years, they only focus on the study of their own professional knowledge, lacking interest in and participation in projects that integrate professional and artificial intelligence technology. Their participation in innovative and entrepreneurial events is not high, resulting in the implementation of innovative and entrepreneurial education in application-oriented universities becoming a mere formality.

B. Lack of teachers with the concept of "new engineering & artificial intelligence" in innovative education

Most application-oriented universities do not have a professional team of teachers for innovation and entrepreneurship, and due to the insufficient number of teachers, many majors have instructors or administrative staff to teach innovation and entrepreneurship courses, which leads to a superficial effect in teaching. Most full-time teachers have not received systematic training and education in innovation and entrepreneurship, and lack certain practical entrepreneurial experience, which makes it impossible for them to propose scientific solutions to problems encountered in the actual entrepreneurial process. The era of "new engineering & artificial intelligence" requires that teachers for innovation and entrepreneurship not only have systematic innovation and entrepreneurship theories and practical experience, but also have artificial intelligence concepts and knowledge that can be integrated with professional cross-disciplines. This places high demands on teachers' personal abilities, so improving the quality of teachers is a difficult task, and more support is needed in teacher training and school-enterprise cooperation.

C. Lack of organic integration between innovation and entrepreneurship education and professional education

Taking Hangzhou Normal University as an example, it has opened undergraduate innovation and entrepreneurship education courses and undergraduate innovation and entrepreneurship education practice courses in the third or fourth semester, and added 6 credits of innovation and entrepreneurship quality development practice. The establishment of independent innovation and entrepreneurship courses aims to cultivate students' innovation and entrepreneurship awareness, thinking, spirit and ability, but its educational effect cannot be seen in the short term. Due to the independent establishment of innovation and entrepreneurship courses, the use of unified teaching materials, and the lack of integration with similar disciplines and professional courses, practical training cannot be truly implemented, making it difficult to systematically cultivate students' innovative thinking, which seriously restricts the development of students' practical ability. Therefore, it is necessary to organically integrate innovation and entrepreneurship education with professional education system in stages and levels.

III. OVERALL IDEAS FOR THE REFORM OF THE CULTIVATION MODE OF INNOVATIVE AND ENTREPRENEURIAL TALENTS

Led by the goal of cultivating moral and talented people, a dual-innovation talent cultivation model of "horizontal integration & vertical progression" is proposed. Through the dual-dimensional design of time and content, a comprehensive and organic cultivation system is constructed. On the horizontal dimension, supported by the practical teaching platform, the three elements of innovation and entrepreneurship education, curriculum system, and artificial intelligence are deeply integrated in a hierarchical and phased manner through the reconstruction of talent cultivation programs, in order to achieve the goal of interdisciplinary cross-fertilization. On the vertical time dimension, innovation and entrepreneurship education is divided into four progressive levels, including theoretical education, project training, science and technology competitions, and entrepreneurial practice, to ensure that students can acquire knowledge and skills that meet their growth needs at different stages. At the same time, a ladderstyle teaching curriculum system is established, including four stages of professional foundation, professional technology, comprehensive practice, and engineering practice, to comprehensively cultivate students. In the field of artificial intelligence, computational thinking is first cultivated, and then students' programming thinking and application abilities are gradually cultivated, ultimately stimulating their innovation potential.

On the same time dimension, the organic integration of three elements of innovation and entrepreneurship education, curriculum system, and artificial intelligence has also been carried out. Firstly, while conducting innovation and entrepreneurship education, general education in the field of artificial intelligence is introduced, and professional basic courses are integrated with innovative elements, which not only makes the course content more attractive, but also enhances students' understanding and attention to artificial intelligence and innovation. In the stage of innovation and entrepreneurship training, the organic integration of artificial intelligence basic courses and professional courses is carried out, and the learned artificial intelligence technology is applied in experiments to ensure that students gain real basic practical experience. In the comprehensive practice stage, students are encouraged to actively participate in science and technology competitions and apply artificial intelligence technology to solve real-world problems, which not only improves students' skill level, but also cultivates their innovative spirit and problem-solving ability. In this way, the teaching effect is further improved. Finally, in the engineering practice stage, the innovation and entrepreneurship education is upgraded to the level of entrepreneurial practice by combining artificial intelligence technology, and high-level talents are cultivated in cooperation with enterprises to provide students with a platform and skills to transform artificial intelligence skills into innovative products and solutions, thus laying a solid foundation for future career success. The core goal of the innovation and entrepreneurship talent training model is to cultivate students' three key abilities, which are intertwined and form an organic whole:

1. Professional basic skills: To cultivate students to acquire a solid professional foundation, and gradually enhance their professional knowledge and skills in specific fields through the vertical progression of the curriculum system.
2. Professional innovation ability: Through horizontal integration, students can combine knowledge and skills from different disciplines to promote innovative thinking and the cultivation of interdisciplinary innovation ability.
3. Public competencies for innovation and entrepreneurship: We focus on cultivating students' public competencies in innovation and entrepreneurship, such as communication, teamwork, problem solving, and leadership, so that they can stand out in a diverse work environment. Through this model, we provide students with a more comprehensive education, enabling them to become innovative and entrepreneurial talents with comprehensive qualities and interdisciplinary backgrounds, and fully prepare for future career and social challenges.

IV. REFORM MEASURES FOR THE CULTIVATION MODE OF INNOVATIVE AND ENTREPRENEURIAL TALENTS

A. Upgrading and transformation of AI in various stages of talent cultivation

In the longitudinal time dimension, it is divided into 4 stages:

1. In the professional foundation stage, reforms are carried out from two aspects: First, introducing general education courses on artificial intelligence, with the aim of guiding college students to cultivate a scientific view of intelligent culture, thereby solving the problem of college students' limited understanding of artificial intelligence and insufficient emphasis on artificial intelligence.General education courses can be achieved by upgrading existing public basic courses (University Computer Application Foundation).Second, in conjunction with mathematics majors, we should strengthen the reform of mathematics teaching, so that students can learn to derive linear regression models and various neural network models in artificial intelligence knowledge, lay a solid foundation in mathematics, enhance computational thinking, and provide the driving force for the application of artificial intelligence in the later stage.In the professional foundation stage, we should focus on cultivating and enhancing students' computational thinking, fundamentally changing the requirements for college students' computer literacy in the old system.
2. During the professional technical learning stage, introduce the introductory course of Python programming for artificial intelligence programming, focusing on cultivating students' programming thinking. With the help of Python's powerful computing ecosystem and excellent cases from various industries, integrate the needs of students' majors (such as civil engineering, transportation engineering, agronomy, animal medicine, etc.), promote teaching reform, and cultivate students' ability to use programs to solve professional problems.On this basis, combine new methods and technologies in the field of artificial intelligence to enhance students' innovation awareness and ability.At the same time, fully integrate the teaching of Python programming courses for non-computer majors with the National Computer Level 2 Exam, and promote teaching through examination.
3. In the comprehensive practice stage, introduce maker equipment, establish a "learning and competition as one " maker space, and focus on cultivating students' artificial intelligence application capabilities. Introduce and introduce artificial intelligence application cases, allowing students to build and complete application scenarios such as face recognition, speech recognition, robot control, and other innovative applications through artificial intelligence algorithms, deep learning, and other technologies.
4. In the engineering practice stage, focus on the full process coverage of innovative projects, connecting the early-stage course experiments, late-stage graduation internships, and graduation design. Deeply understand the integration point between industry applications and artificial intelligence technology, and complete the

application of learning and innovation and entrepreneurship.

B. Promote the effective integration of innovation and entrepreneurship education into professional education

Taking computer science as an example, according to the progressive curriculum system of professional education, the integration of entrepreneurship education and professional education can also be divided into four stages in the time dimension:

1. While carrying out "innovation and entrepreneurship" general education for freshmen, we can also use maker spaces or school-enterprise cooperation platforms to offer experiential courses, such as professional cognitive practice courses. Teachers can organize students to visit and experience the latest technology products in enterprises, understand the technical elements, economic value, and social value of the products, and then guide students to find their interests based on their own experiences. In the school's maker lab, students can form interest groups to build simple projects.Through this initial experience of design, it can stimulate students' innovative consciousness and lay a good foundation for subsequent professional learning and entrepreneurial innovation projects.
2. In the second year, based on the characteristics of the major, lectures are offered, such as inviting experts from enterprises to give lectures on innovation, entrepreneurship, and artificial intelligence. This allows students to have a more direct and profound understanding of entrepreneurship and enterprise innovation, and to have a better understanding of the application of the latest technologies such as artificial intelligence.At the same time, basic skills courses are reformed, such as embedded courses and programming courses, incorporating elements of entrepreneurship and innovation and artificial intelligence. Students are encouraged and guided to apply for the College Innovation and Entrepreneurship Training Program, taking the first step towards interdisciplinary project development.
3. In the third year, based on the characteristics of the major, elective courses strongly related to "innovation and entrepreneurship" are offered, such as embedded application courses and artificial intelligence application courses, to enable students to gain practical skills in complex projects.At the same time, project training is carried out in combination with professional courses and driven by discipline competitions, so that students can participate in various mass entrepreneurship and innovation technology competitions such as "Internet plus College Students Innovation and Entrepreneurship Competition" and "Challenge Cup", thus improving their practical ability
4. In the senior year, we will work with university-enterprise cooperation platforms to provide students with an engineering research and development practice platform. In addition to providing internship and practical environments, we will also provide support for the application and incubation of projects with entrepreneurial potential.

C. Implementing the "four-dimensional integration" mentorship system for innovation and entrepreneurship

Establishing a sound mentorship system for innovation and entrepreneurship is an important guarantee for the development of innovation and entrepreneurship education. At present, most universities do not have a clear management mechanism for the mentorship team for innovation and entrepreneurship. Many innovation projects are undertaken by students themselves or selected by teachers from the class. The science and controllability of the management process is insufficient. Therefore, the implementation of the four-dimensional mentorship system of "classroom & competition & scientific research & project" is more scientific in using excellent teachers. The mentorship team for innovation and entrepreneurship needs to be composed of professional teachers with strong sense of responsibility, professional competence, and artificial intelligence literacy. They provide comprehensive guidance to students from four dimensions: First, professional course guidance. Since professional teachers are responsible for teaching courses related to their major, they can also guide students in career planning. Second, subject competition guidance. By using the teachers' own expertise in their professional fields, they can better guide students to participate in various innovation and entrepreneurship competitions. Third, scientific research guidance. Students who are interested can be absorbed to participate in the scientific research projects of professional teachers, stimulating their interest in scientific research and innovation awareness. At the same time, students' innovative thinking can also feed back to the scientific research projects of teachers. Fourth, guidance for entrepreneurial incubation. It provides guidance and technical support for students' innovation and entrepreneurship projects[5].

D. Constructing a diversified practical teaching support platform

Courses with strong practicality usually have experimental teaching hours or course design hours, but only for students in the course to practice, lacking the cultivation of engineering practical ability and exploration of emerging fields, making it difficult to form innovative entrepreneurial abilities. Therefore, it is necessary to build and improve relevant laboratories and training platforms according to the professional training objectives, make full use of existing teaching resources, and explore and expand the connotation and extension of innovative entrepreneurial practice training teaching.

1. Establish a "learning and competition" maker space

Taking the computer and electronic information major as an example, in order to support the practical training of science and technology competitions and artificial intelligence projects, the maker space has expanded its equipment configuration into five levels: First, infrastructure, such as computers, network equipment, oscilloscopes, etc.; Second, control boards, such as AI core boards, Raspberry Pi control boards, etc.; Third, various sensors, such as high-definition video heads, ultrasonic modules, etc.; Fourth, various communication modules, such as Wifi, NB-IoT, ZigBee, etc.; Fifth, mechanical platforms, such as robots, drones, 3D printers, etc. [6]. In the maker space, it can not only meet the practical operation of various professional courses such as embedded, artificial intelligence applications, Internet of Things, and circuit design, but also be used for students' "double innovation" project training, discipline competition project training and guidance work.

2. Reform and upgrade the experimental teaching platform

For the characteristics of professional courses, mechanical and electrical courses can introduce cloud simulation platforms or virtual simulation platforms. For example, in the basic course of embedded systems, with the help of Tinkercad online electronic circuit design platform, it is possible to simulate and test circuit behavior, which helps students better understand and apply embedded principles and technologies. For programming courses, online evaluation and management platforms can be introduced. For example, in the Python programming course, the Python123 online program evaluation platform is introduced. Teachers can evaluate students' programs in real time during the experimental class, and students can also get real-time results and feedback, which helps teachers and students quickly identify and correct potential problems, thereby improving learning efficiency.

3. Promote the construction of a platform for school-enterprise cooperation

Promote the construction of on-campus training bases for school-enterprise cooperation, inject new elements of artificial intelligence into the school-enterprise cooperation platform. Engage enterprise experts to teach AI courses; encourage teachers to collaborate with enterprises to carry out innovative scientific research projects, and provide teachers with more opportunities for enterprise training, cooperation, and exchange; school-enterprise jointly develop comprehensive and innovative experimental projects. Through the "double introduction and one delivery" mechanism, build a high-level double-teacher team, that is, employ senior engineers from enterprises as teachers, engage external enterprise engineers to participate in practical courses, and send professional teachers to off-campus enterprises for practical training. This mechanism can greatly enhance teachers' engineering practice teaching ability.

V. PROPORTION DISTRIBUTION OF EACH GRADE WITH OR WITHOUT AI IN FOUR COURSES

In our study, we focused on students from two Computer Science and Technology classes of the 2021 cohort as experimental subjects. They were tasked with using three large-scale models—GPT-4, GPT-3.5, and the Spark Model—to aid in the writing of algorithms and logic functions within their project programming. This included

TABLE 1 Proportion Distribution of each Grade with or without AI in four Courses

	C language programming				Web programming				Java programming				Algorithm analysis			
	No AI	With GPT-4	With GPT-3.5	With Spark	No AI	With GPT-4	With GPT-3.5	With Spark	No AI	With GPT-4	With GPT-3.5	With Spark	No AI	With GPT-4	With GPT-3.5	With Spark
90-100	10.5%	24.1%	27.1%	15.1%	10.3%	14.0%	14.1%	11.2%	10.3%	13.1%	9.9%	10.1%	8.3%	13.1%	13.4%	9.8%
80-90	24.0%	51.0%	38.0%	38.0%	28.6%	48.0%	34.5%	33.2%	25.6%	53.2%	38.0%	32.8%	22.3%	40.2%	31.6%	32.7%
70-80	32.8%	14.8%	19.9%	25.9%	26.7%	23.4%	26.1%	25.4%	28.9%	23.7%	29.1%	30.4%	35.3%	28.7%	30.8%	28.4%
60-70	22.3%	8.1%	11.0%	14.4%	20.5%	11.4%	16.4%	18.7%	21.5%	10.0%	17.7%	19.1%	23.5%	13.2%	17.4%	19.7%
<60	10.4%	2.0%	4.0%	6.6%	13.9%	3.2%	8.9%	11.5%	13.7%	0.0%	5.3%	7.6%	10.6%	4.8%	6.8%	9.4%

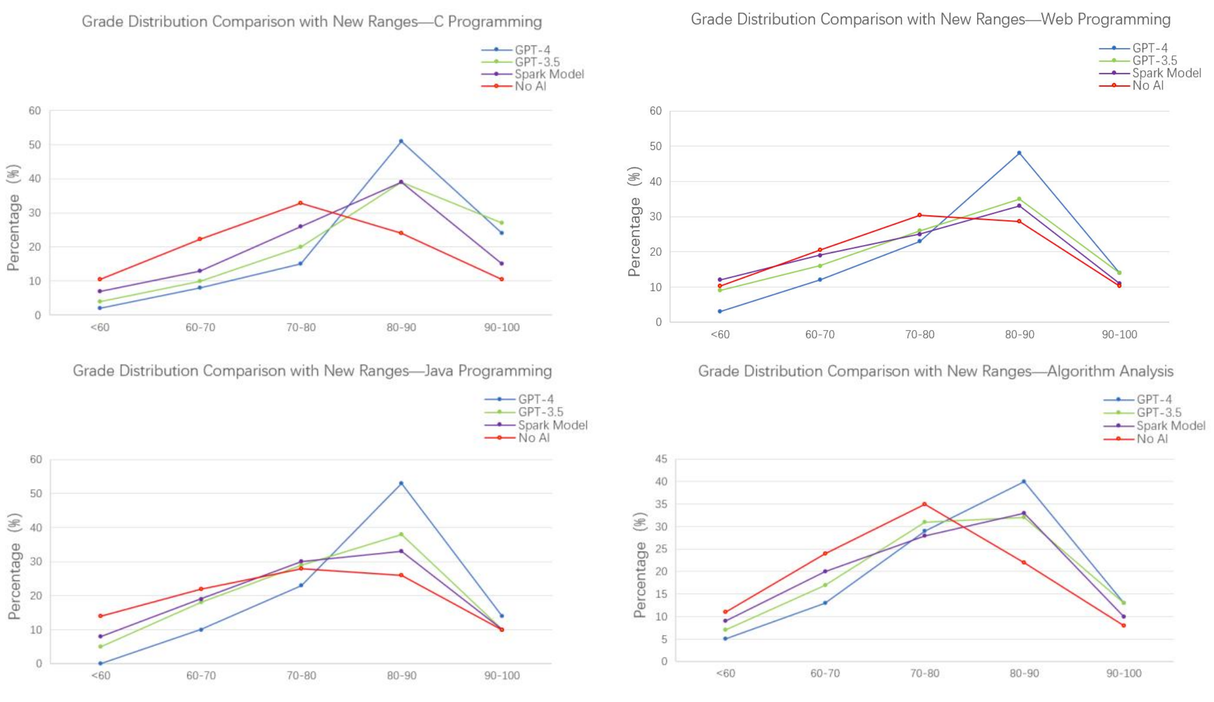

Fig. 1 Grade Distribution Comparison with New Ranges with or without AI in four Courses

areas such as C programming, Web programming, Java programming, algorithm analysis. The students were divided into two groups: Group A, which did not employ large models for project design, and Group B, which was required to use large models to complete the main logical functionalities. Afterward, we scored the projects and compared the students' grade distributions, yielding the results depicted in Table 1 and Fig.1.

The data from Table 1 suggest that the use of large models led to a general improvement in students' grades. Specifically, the proportion of B and C grades increased across the majority of courses, indicating a positive effect of large models on assisting with program design. On the other hand, the percentage of F grades significantly decreased, even dropping to zero in some courses. This indicates that for students with lower skill levels, the quality of task completion improved markedly with the assistance of large models. As illustrated in Figure 1, the traditional teaching model, which typically resembles a spindle shape (with fewer high and low grades and most grades in the middle), shifted to a triangular model (majority high and medium grades with very few low grades) with the incorporation of large model assistance. Consequently, it is imperative for university education to re-evaluate the timing and methods of introducing artificial intelligence to students and to consider when its application should be limited, in order to better prepare for future practical demands.

VI. ANALYSIS OF THE IMPORTANCE AND SATISFACTION OF INNOVATIVE TALENTS CULTIVATION

This article attempts to construct an evaluation index system for the quality of innovative talents cultivation (Table 2) through in-depth interviews with multiple university innovation and entrepreneurship instructors, as well as drawing on relevant research findings[7].

The data used in this article was mainly obtained through questionnaire surveys. The survey questionnaire mainly includes three parts: the information of the respondents, including gender, age, grade, and major; students' awareness of innovation and entrepreneurship talent cultivation; students' satisfaction and expectations of the quality of innovative talents cultivation. In the survey questionnaire, the awareness, satisfaction, and expectations of innovative talents cultivation are measured using a 5-point Likert scale. The IPA method is mainly used to statistically analyze the satisfaction and importance of innovative talents cultivation quality.

The questionnaire was mainly distributed to students at Hangzhou Normal University. A total of 330 questionnaires were distributed from March to June 2023, and after eliminating some incomplete items and questionnaires with unclear understanding of dual-integration talent cultivation, 301 valid questionnaires were finally collated. Using SPSS software, 16 evaluation indicators in the questionnaire were analyzed for reliability and KMO value test. The results showed that both Cronbach's alpha coefficient and KMO value were greater than 0.9, indicating that the data used in this study had high credibility.

The importance analysis shows that the promotion of professional education, teamwork ability cultivation, and the completeness of the curriculum system by school-enterprise cooperation and innovation and entrepreneurship rank among the top three in terms of importance scores, indicating that students are more focused on the process and effectiveness of talent cultivation. From the perspective of satisfaction analysis, the overall satisfaction is relatively low, with all indicators averaging below 4, indicating that the school needs to make greater efforts in talent cultivation. Further analysis found that the satisfaction of employment and enrollment conditions and starting salary is high, but the satisfaction of the number of training and lecture activities, the completeness of the curriculum system, and the guidance of part-time teachers from enterprises is low, indicating that students are more satisfied with the effectiveness of the school's innovative talents cultivation, but the construction of talent cultivation platform needs to be further strengthened.

TABLE 2 EVALUATION INDICATOR SYSTEM FOR THE QUALITY OF INNOVATIVE TALENTS CULTIVATION

Evaluation elements	Evaluation indicators
Fundamentals of Talent Cultivation I_1	I_A The importance of talent cultivation
	I_B Guarantee degree of talent cultivation
	I_C Completeness of curriculum system
	I_D Teacher level of course teaching
Talent cultivation platform I_2	I_E Guidance of part-time teachers in enterprises
	I_F Quantity of internship and training bases inside and outside the school
	I_G The number of training, lectures and other activities
	I_H The quality of training, lectures and other activities
Talent cultivation process I_3	I_I Talent cultivation planning
	I_J Talent cultivation planning
	I_K Participation in student innovation and entrepreneurship and academic competitions
	I_L Government, society, industry and enterprise collaborate to cultivate talents
	I_M Cultivation of innovative entrepreneurial thinking and awareness
Effectiveness of talent cultivation I_4	I_N Employment platform
	I_O Employment and further education
	I_P Starting salary for employment

From the comparison of the satisfaction and importance of indicators (Table 3), the satisfaction and importance of the three indicators of the completeness of the curriculum system, the promotion of professional education by school-enterprise cooperation and innovation and entrepreneurship, and the number of internship and training bases inside and outside the school have the largest difference, indicating that these aspects need to be optimized and improved in the process of cultivating innovative talents. In addition, the satisfaction of cultivating innovative thinking and awareness as well as talent cultivation planning is higher than the importance, which indicates to some extent that the school's practices in these aspects have been highly evaluated by students.

Through empirical data analysis, we explore the impact of introducing AI and other courses in higher education on students' future development. We selected an experimental class (implementing an AI curriculum) and six traditional classes (not implementing an AI curriculum) as samples, and compared and analyzed the differences in the

TABLE 3 COMPARISON OF THE MEAN VALUES OF EVALUATION INDEX IMPORTANCE AND SATISFACTION

Evaluation indicators	Mean value of importance E	Mean value of Satisfaction S	E - S
I_A	4.20	3.90	0.30
I_B	2.10	3.92	-1.82
I_C	4.31	3.58	0.73
I_D	4.32	3.92	0.40
I_E	4.08	3.93	0.15
I_F	4.21	3.82	0.39
I_G	3.92	3.76	0.16
I_H	4.12	3.90	0.22
I_I	3.92	3.85	0.07
I_J	4.05	3.65	0.40
I_K	4.23	3.75	0.48
I_L	4.01	3.85	0.16
I_M	3.89	3.51	0.38
I_N	4.25	3.94	0.31
I_O	4.31	3.91	0.40
I_P	4.26	3.96	0.30

enrollment rate, success rate, overseas rate, employment rate, average salary, and number of offers received between the two groups of students. Below is the comparative data between the experimental and traditional classes(Table 4):

TABLE 4 COMPARISON OF DATA BETWEEN EXPERIMENTAL AND TRADITIONAL CLASSES

Metric	Experimental Class	Traditional Class	Comparative Increase Percentage
Postgraduate Exam Rate	82.7%	66.2%	+24.92%
Postgraduate Success Rate	42.7%	26.2%	+62.98%
Study Abroad Rate	24%	15%	+60.00%
Employment Rate	90%	67%	+34.33%
Average Salary	40% higher than Traditional Class	-	+40%
Number of Offers	50% more than Traditional Class	-	+50%

The data show that students in the experimental class significantly outperformed those in traditional classes in all measured indicators. This result emphasizes the importance of AI education in enhancing students' professional skills and augmenting their academic and career development opportunities. This study confirms that introducing AI courses in higher education can significantly enhance students' overall abilities and potential for future development, providing important reference for educational institutions in curriculum planning.

VII. CONCLUSION

In the context of the development of new engineering and artificial intelligence in China, the innovation and entrepreneurship education mechanism and talent cultivation model in application-oriented universities need to be effectively reformed and upgraded in line with the changing needs of the times. In order to address the problems in the education of innovation and entrepreneurship, and in combination with practical needs, a "horizontal integration & vertical progression" talent cultivation model for innovation and entrepreneurship has been proposed to enhance students' abilities in artificial intelligence literacy, innovation and entrepreneurship awareness, and interdisciplinary integration. This new model requires breaking down barriers between majors and restructuring talent training programs horizontally, ensuring that AI upgrades are incorporated into all stages of talent training. It also emphasizes the integration of innovation and entrepreneurship education throughout the entire process of talent training. In the vertical dimension, it is necessary to establish a progressive teaching curriculum system to better meet the needs of students at different stages of learning. In the specific implementation process, we will enrich the teaching mode by reforming the curriculum system, and stimulate students' innovation and entrepreneurship. Strengthen the management of the process of innovation and entrepreneurship, and improve the quality of the mentor team for innovation and entrepreneurship; Build innovative training platforms at different levels to better support the integration of entrepreneurship and innovation education, artificial intelligence technology, and professional education. The proposal of the "horizontal integration & vertical progression" dual-innovation talent cultivation model provides a new forward-looking, flexible, and practical talent cultivation model for application-oriented universities. This model not only helps students better adapt to the needs of the new era, but also injects new vitality into the innovative development of application-oriented universities in the field of talent training, so that they can cultivate more innovative and entrepreneurial talents.

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REFERENCES

[1] Chen Cong. Innovation and entrepreneurship orientation and suggestions for computer majors in new engineering disciplines in the context of artificial intelligence [J]. Education Modernization, 2020, 7(56): pp.59-62.
[2] Xu Tao, Yan Li, Yin Junfeng, et al. Research on the Development Mode and Path of "Artificial Intelligence & New Engineering" from the Perspective of Innovation and Entrepreneurship Education [J].Journal of Distance Education, 2018, 36(1),pp.80-88.
[3] Zhang Meiyan.Analysis of the Skills of "Intelligent Manufacturing" Talents under the New Scientific and Technological Revolution [J]. Cooperative Economy and Technology, 2017, 564 (13),pp.148-151.
[4] Wu Xuesong.The Current Situation, Problems and Countermeasures of Innovation and Entrepreneurship Education in Application-oriented Universities [J]. Education and Occupation, 2020, 957 (5),pp.56-61.
[5] Deng Xiaohong, Liu Huiwen.Research on the promotion strategy of information technology college students' innovation and entrepreneurship ability under the background of new engineering discipline - taking the College of Applied Sciences of Jiangxi University of Science and Technology as an example [J].Innovation and Entrepreneurship Education, 2020, 11(2),pp.33-38.
[6] Peng Yihong, Cheng Li. Embedded Teaching Reform and Practice of Integrating Maker Education Mode [J]. Journal of North China University of Science and Technology (Social Science Edition), 2021, 21(3),pp.86-90.
[7] Hu Zhengming. Research on the construction of evaluation index system for innovation and entrepreneurship education in higher

vocational colleges [J]. Journal of Vocational and Technical Education in China, 2018(8): pp.72-77.

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