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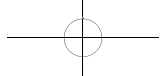
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## Education Reform and Development

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*Educational Reform and Development* is a peer-reviewed, open-access international professional academic journal. The column of *Educational Reform and Development* includes comments, basic researches, literature reviews and research letters. Manuscripts should be scientifically advanced, readable and practical, with prominent points, concise words, reliable data, standard writing and accurate expression. The main readers of this journal are principals, teachers, education administrators, education researchers, and domestic and foreign researchers concerned with adolescent education.

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# Teaching Reform and Practice of the Course “Electrical Control and PLC Technology” Based on OBE Concept

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**Abstract:** With the deepening of educational reform, the teaching of the course “Electrical Control and PLC Technology” should be further optimized. When carrying out educational work, teachers should try to introduce some new technologies, methods and ideas to ensure the quality and efficiency of the teaching of “Electrical Control and PLC Technology.” The teaching reform of “Electrical Control and PLC Technology” under the OBE concept can greatly enrich the teaching content of the course, broaden the path of education, and greatly promote the comprehensive development of students. In view of this, this paper will analyze the teaching of “Electrical Control and PLC Technology” based on the OBE concept and put forward some strategies, which are for reference only.

**Keywords:** OBE concept; “Electrical Control and PLC Technology” course; Teaching reform

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## 1. Overview and analysis of the OBE concept

Outcomes-Based Education (OBE), an education model centered on learning outcomes, first emerged in the field of basic education in countries such as the United States and Australia, becoming a key achievement in basic education reforms<sup>[1]</sup>. This educational model emphasizes student learning outcomes as the orientation, focusing on the cultivation of students’ abilities and their practical application, rather than merely imparting knowledge. In the 1980s, the American education community conducted in-depth discussions on the OBE concept and continuously enriched and developed it in practice. American educational scholars defined the OBE concept as: a more explicit organization and concentration of the education system to ensure that students can achieve success in their future lives. They believe that education should be student-centered, pay attention to individual differences among students, and provide personalized learning paths to meet the needs of different students. The Australian education sector, on the other hand, defines OBE as an educational process aimed at achieving specific learning outcomes for students. Guided by this concept, the structure of educational work and curriculum



content are regarded as tools to achieve educational goals. Education itself is not the ultimate goal; its core purpose is to assist students in developing specific abilities and qualities. Australian educational practitioners emphasize that the OBE model requires educators to clearly define the learning outcomes that students should achieve, and design courses and teaching activities based on this orientation. This model encourages students to actively participate in the learning process, master knowledge and skills through practice and exploration, to better prepare for future study and life.

## **2. The value of teaching reform in the course “Electrical Control and PLC Technology” based on the OBE concept**

### **2.1. Helping to stimulate students’ potential**

Carrying out the teaching reform of the “Electrical Control and PLC Technology” course based on the OBE concept can further stimulate students’ interest in learning, prompting them to participate in knowledge exploration and learning more actively and enthusiastically. This is of great significance for enhancing their learning interest and can effectively stimulate students’ potential. Through the teaching reform of the “Electrical Control and PLC Technology” course, students can not only master theoretical knowledge but also develop higher-level practical abilities and comprehensive literacy. The more rational introduction of Internet technology, big data technology, etc., can promote more all-around development of students and help them form a more positive and healthy professional concept<sup>[2]</sup>. In the teaching of the “Electrical Control and PLC Technology” course, teachers can better integrate theory with practice, significantly deepen students’ mastery of knowledge, cultivate their comprehensive abilities, and stimulate their potential for development.

### **2.2. Meeting the needs of the times**

In today’s society, with the rapid development of science and technology and the continuous improvement of industrial automation, the demand for talent in electrical control and PLC technology is increasing. By implementing the teaching reform of the “Electrical Control and PLC Technology” course based on the concept of Outcome-Based Education (OBE), we can more effectively improve students’ comprehensive literacy, moral character, and practical ability. This teaching reform not only helps students master solid professional knowledge but also stimulates their innovative awareness and critical thinking, to better adapt to the needs of the times<sup>[3,4]</sup>. In the teaching process of the “Electrical Control and PLC Technology” course, students will have the opportunity to combine theoretical knowledge with practical operations, and apply what they have learned to future work practice through practical projects and case studies, satisfying their expectations for knowledge exploration<sup>[5]</sup>. This is not only conducive to the improvement of students’ knowledge system but also of great significance for enhancing their practical ability and problem-solving literacy. Therefore, carrying out the teaching reform of the “Electrical Control and PLC Technology” course can help students achieve more long-term and all-round development and cultivate more high-quality talents with innovative ability and practical skills for society<sup>[6]</sup>.

### **2.3. Conducive to promoting educational reform**

Under the guidance of the OBE concept, the implementation of the teaching reform of the “Electrical Control and PLC Technology” course can effectively promote the current educational work. This reform makes education more reasonable and scientific, and helps teachers introduce more new ideas and technologies in educational activities, thereby enhancing students’ initiative in knowledge exploration and learning interest. In addition,

combining the OBE concept to carry out the teaching reform of the “Electrical Control and PLC Technology” course can achieve a breakthrough and innovation in the traditional teaching mode and content, break the old teaching framework, and introduce more teaching methods and means in line with modern educational concepts. This can not only inject new vitality into educational work but also help to enhance the depth of educational reform and promote the overall improvement of educational quality. Through such reforms, we can cultivate more high-quality technical and skilled talents who can meet the needs of future social development.

### **3. Current teaching situation of the course “Electrical Control and PLC Technology”**

#### **3.1. Lack of student interest and unclear goals**

In the teaching of the “Electrical Control and PLC Technology” course, teachers will find a problem: students usually lack a clear goal to guide them in their learning activities. This leads to a lack of interest and motivation when they study the knowledge in this course. In addition, due to the unclear teaching goals of the “Electrical Control and PLC Technology” course, teachers also lack a clear direction for development when carrying out educational work, which further exacerbates the problem of students’ lack of interest. Moreover, we have observed that in class, some students often show inattentive behaviors such as being distracted or playing with their mobile phones. These behaviors not only pose a great obstacle to the smooth progress of teaching work but also are not conducive to building a good teaching atmosphere <sup>[7,8]</sup>. The existence of this phenomenon undoubtedly hurts students’ future development and limits the exertion of their learning potential.

#### **3.2. Outdated educational model and imperfect curriculum system**

In the current teaching practice of the “Electrical Control and PLC Technology” course, teachers can see a relatively common problem: many teaching models lack necessary innovation and improvement <sup>[9]</sup>. This traditional and outdated educational model has caused considerable obstacles to the subsequent educational work and restricted the expansion of students’ thinking and the cultivation of their innovative abilities. At the same time, we also find that the teaching system of the “Electrical Control and PLC Technology” course has certain imperfections. In the teaching process, many teachers tend to impart theoretical knowledge while ignoring the introduction and strengthening of practical teaching content. This curriculum system, which emphasizes theory over practice, is not conducive to the cultivation and development of students’ practical abilities, thus affecting the overall teaching effect of the “Electrical Control and PLC Technology” course. To improve this situation, we need to reform the teaching model and strengthen the practical teaching links, so that students can deepen their understanding through practical operations while learning theories and improve their ability to solve practical problems. Only in this way can we cultivate talents in electrical control and PLC technology who understand both theories and have practical skills, meeting the needs of society and the industry.

#### **3.3. Unreasonable curriculum design and insufficient ability to apply knowledge**

In the teaching design of the “Electrical Control and PLC Technology” course, there is a certain deviation between the course content designed by many teachers and the actual needs of students <sup>[10]</sup>. This unreasonable design not only fails to meet students’ learning needs well but also hinders the cultivation and development of students’ comprehensive abilities to a certain extent. In addition, during the teaching process, we find that there is a lack of an effective practical teaching model, which leads to students’ insufficient ability in knowledge



application. This insufficiency in knowledge application makes it difficult for students to effectively apply the knowledge they have learned to solve problems when facing actual work, which is not conducive to improving their competitiveness in the workplace in the future. Therefore, we need to reflect on and improve the existing teaching design to better meet students' learning needs, enhance their practical abilities and knowledge application abilities, and thus lay a solid foundation for their future career development.

## **4. Teaching reform strategies for the course “Electrical Control and PLC Technology” based on the OBE concept**

### **4.1. Align with market demands and clarify educational goals**

Under the guidance of the OBE concept, to further improve the teaching effectiveness of the “Electrical Control and PLC Technology” course, teachers need to establish clear and specific educational goals. Such goals can provide a clear direction for teaching activities. To achieve this, teachers should conduct an in-depth analysis of market demands and explore the teaching content of the course thoroughly <sup>[11]</sup>. This approach ensures that the teaching content is consistent with actual market needs, laying a solid foundation for setting teaching goals. In the process of market demand research, teachers should make full use of modern information technology, which not only significantly improves the efficiency of the survey but also ensures the rationality and scientificity of the results. Based on the market demand information obtained from the survey, teachers should further clarify educational goals, ensuring that the teaching of “Electrical Control and PLC Technology” meets market expectations and effectively enhances the educational effect.

### **4.2. Focus on work processes and optimize the curriculum system**

In the traditional teaching of “Electrical Control and PLC Technology,” the curriculum system was often dominated by theoretical courses. This model may restrict students' all-around development, as the lack of sufficient practical links is detrimental to improving their ability to solve practical problems <sup>[12]</sup>. Therefore, in the teaching reform of “Electrical Control and PLC Technology” based on the OBE concept, teachers should take more proactive measures. For example, they can conduct an in-depth analysis of actual enterprise work processes and introduce practical course content based on this analysis. This method can effectively optimize and innovate the curriculum system of the course, allowing students to more intuitively feel the development and progress of the times in the process of knowledge exploration, thereby better stimulating their interest and enthusiasm for learning <sup>[13]</sup>. In addition, optimizing the curriculum system of “Electrical Control and PLC Technology” can deepen students' understanding of the relevant industry, laying a more solid foundation for their future career development.

### **4.3. Enrich teaching approaches to stimulate students' interest**

In carrying out the teaching reform of “Electrical Control and PLC Technology” based on the OBE concept, teachers should attach importance to stimulating students' interest and continuously enrich the approaches and forms of teaching to provide students with higher-quality teaching services. Much of the content in “Electrical Control and PLC Technology” is abstract. When teaching such knowledge, teachers can try to integrate project-based teaching and case-based teaching methods to ensure students' understanding efficiency and depth of exploration, thereby enhancing the effect of the course reform <sup>[14]</sup>. In addition, teachers can carry out educational activities using micro-lectures. Introducing interesting and educational micro-lecture videos into the course

can help students effectively break through key and difficult knowledge points, facilitating more efficient knowledge exploration. This greatly promotes students' interest in knowledge exploration. By continuously enriching teaching approaches, the effect of the teaching reform of "Electrical Control and PLC Technology" can be significantly improved, creating a better learning atmosphere for students and promoting their long-term development.

#### **4.4. Emphasize environment construction and cultivate a "Dual-Qualified" teacher team**

To enhance the effect of the teaching reform of "Electrical Control and PLC Technology" based on the OBE concept, teachers should pay attention to building and optimizing a high-quality teaching environment during the teaching process. This can provide support for subsequent teaching activities, allowing students to explore and learn course knowledge in a free and pleasant atmosphere, and improving their ability to apply knowledge. In constructing the teaching environment for "Electrical Control and PLC Technology," teachers should focus on introducing new methods and concepts to provide students with better educational services <sup>[15]</sup>. To ensure the effectiveness of the course reform, schools should continue to deepen the cultivation of a "dual-qualified" teacher team (teachers with both academic expertise and industry experience), providing more opportunities for teachers to participate in enterprise practice. This allows them to communicate more deeply with enterprise employees and leaders, which is of great significance for improving their practical teaching ability. Through practice in enterprises, teachers can accumulate more new ideas and learn more new technologies, which greatly promotes their subsequent teaching activities. In addition, schools can invite enterprise employees and leaders to give lectures in the school, helping students understand more industry knowledge and development trends, and supporting their comprehensive development.

### **5. Conclusion**

In summary, to further enhance the teaching effectiveness of the "Electrical Control and PLC Technology" course based on the OBE (Outcome-Based Education) concept, teachers can start from aspects such as integrating market demands, focusing on work processes, enriching teaching approaches, and attaching importance to the construction of teaching environments. By doing so, the teaching effectiveness of the "Electrical Control and PLC Technology" course can be imperceptibly elevated to a new level.

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### **Disclosure statement**

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# Research on the Optimization of the Integrated and Collaborative Mechanism for Ideological and Political Education in Primary, Secondary and Tertiary Education Institutions of China's New Era

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**Abstract:** The fundamental task of moral education in the new era is the systematic construction of ideological and political education. This study comprehensively examines the development process and implementation challenges of the integration of ideological and political education in China since the reform and opening-up through literature review, case studies, and field research. The study found that China's moral education system has undergone a paradigm shift from "political education" to "comprehensive moral education," exhibiting significant policy-driven characteristics. Inadequate coordination mechanisms and limited horizontal synergy effects are the primary challenges currently facing the development of ideological and political education courses, with their root causes lying in structural contradictions in the supply side of collaborative governance mechanisms. Based on the example of the integration of ideological and political education in primary, secondary, and higher education institutions in Zhongshan City, Guangdong Province, the study proposes a new four-dimensional collaborative mechanism involving the family, school, society, and the internet. The family dimension focuses on the daily immersion in excellent traditional culture; the school dimension constructs a composite education system with spiral-shaped content development, cross-disciplinary teacher training, and multi-dimensional evaluation; the social dimension builds a platform for practical education communities; and the internet dimension innovates the digital education ecosystem. The research findings indicate that this mechanism can effectively promote the integrated connection and coordinated development of ideological and political education across all educational stages, providing a systematic, innovative solution for the modernization of the ideological and political education system in the new era.

**Keywords:** Integrated curriculum construction; Collaborative mechanism; Moral education

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## 1. Introduction

The Communist Party of China has always attached great importance to the development of ideological and political theory courses (hereinafter referred to as “ideological and political courses”). Since the 18th National Congress of the Communist Party of China, the Party Central Committee has comprehensively strengthened its leadership over the development of ideological and political courses, leading to fundamental and comprehensive changes in the development environment and overall ecosystem of such courses. The reform and innovation of ideological and political courses have entered a new stage of development <sup>[1]</sup>. In 2019, President Xi Jinping over a symposium for teachers of ideological and political theory courses in schools and proposed that ideological and political theory courses should be introduced in primary, secondary, and higher education institutions in a gradual and spiral manner. The report of the 20th National Congress of the Communist Party of China in 2022 clearly stated that “we must improve the ideological and political work system and promote the integrated development of ideological and political education in primary, secondary, and higher education institutions.” In May 2024, President Xi Jinping made important instructions on the construction of ideological and political theory courses in schools, emphasizing the need to deepen the integrated construction of ideological and political education in primary, secondary, and higher education institutions. As we embark on a new journey in the new era, the construction of ideological and political theory courses faces new circumstances and new tasks, and deepening the integrated construction of ideological and political education in primary, secondary, and higher education institutions has become a new requirement for ideological and political theory courses to demonstrate new momentum and achieve new accomplishments <sup>[2]</sup>. However, in the face of new situations, new tasks, and new challenges, some localities and schools still do not fully recognize the importance of ideological and political courses; classroom teaching effectiveness needs to be improved, teaching materials are not lively enough, and there are shortcomings in the selection and training of teachers <sup>[3]</sup>. Therefore, systematically sorting out the historical origins and development of the integrated construction of ideological and political courses in primary, secondary, and higher education, and conducting research on the mechanisms for the integrated construction of ideological and political courses in primary, secondary, and higher education have become topics that will help promote high-quality education.

## 2. The historical background of the integrated construction of ideological and political courses in primary, secondary, and higher education

The integrated construction of ideological and political courses in primary, secondary, and higher education in China is the result of the country’s overall planning of moral education courses and the gradual focus on integration. As one of the “five educations” in schools, moral education is not only the primary means and mechanism for independently implementing “moral education and talent cultivation,” but also runs through or is integrated into the other four educations, becoming the soul of education as a whole. With the deepening of China’s reform and opening-up and the tremendous changes in its economy and society, the positioning, content, and system of moral education have exhibited characteristics of keeping pace with the times, manifested in the prominence of “humanization” over “politicization,” the transition from single “political education” to a rich “comprehensive moral education” framework, and the shift from “campaign-style” to “integrated moral education across all levels of education.” This signifies that moral education must first cultivate a “person,” and on the basis of cultivating a “person,” it must then shape social roles, producing “socialist builders and successors.” This not only requires comprehensive moral education, or “comprehensive moral education,” which



includes moral education for cultivating a “person,” psychological education, and political education, ideological education, and vocational ethics education necessary for assuming social roles, but it should also be an open system characterized by vertical integration and horizontal coordination among its various elements.

From the first mention of “comprehensively planning the school moral education system” in the Central Committee of the Communist Party of China’s “Opinions on Further Strengthening and Improving School Moral Education” in 1994, to the overall design of the “comprehensive planning of the moral education system for primary, secondary, and higher education” in the Ministry of Education’s “Opinions on Comprehensively Planning the Moral Education System for Primary, Secondary, and Higher Education” in 2005, and further to the 2010 “National Medium- and Long-Term Education Reform and Development Plan (2010-2020)” clearly define the requirement of “prioritizing moral education.” The 2000 Opinions of the Central Committee of the Communist Party of China and the State Council on Adapting to New Circumstances and Further Strengthening and Improving Moral Education in Primary and Secondary Schools, which called for “striving to establish a moral education curriculum system for primary and secondary schools that meets the needs of the 21st century”<sup>[4]</sup>, and other documents that have been continuously updated, moral education has consistently been a priority and subject to comprehensive planning at the national level.

### **3. Development of integrated ideological and political education in primary, secondary, and higher education**

Since entering the new era, ideological and political education has been elevated to an unprecedented level. On March 18, 2019, President Xi Jinping over a symposium for teachers of ideological and political theory courses in schools in Beijing and delivered an important speech. He emphasized that adolescence is a critical period in life when young people need careful guidance and cultivation; that we must confidently and resolutely deliver ideological and political courses in our socialist education with Chinese characteristics. It is essential to progressively and spirally advance the teaching of ideological and political theory courses in primary, secondary, and higher education institutions, as this is a crucial guarantee for cultivating generation after generation of builders and successors of socialism<sup>[5]</sup>. In order to thoroughly implement the important statements made by President Xi Jinping on education, especially the spirit of his important speech at the symposium for teachers of ideological and political theory courses in schools, on August 14, 2019, the General Office of the Communist Party of China Central Committee and the General Office of the State Council issued the “Several Opinions on Deepening the Reform and Innovation of Ideological and Political Theory Courses in Schools in the New Era” which clearly stated at the national level that “we must uphold the political and value-oriented role of ideological and political courses in the curriculum system, coordinate the integrated development of ideological and political theory courses across primary, secondary, and higher education institutions, and promote synergies between various courses and ideological and political theory courses,” requiring that through institutional arrangements for ideological and political theory course teaching—particularly textbooks—across different levels and types of schools, vertical coordination be achieved across primary, secondary, and higher education segments, while horizontal coordination be realized through ideological and political theory courses and ideological and political elements integrated into all courses.

On December 18, 2020, the Publicity Department of the CPC Central Committee and the Ministry of Education jointly issued the “Innovation Implementation Plan for Ideological and Political Theory Courses in the New Era.” On July 25, 2022, the Ministry of Education and nine other departments issued the “Work Plan for the

Comprehensive Promotion of the ‘Grand Ideological and Political Education Course’” promoting the upgrade of ideological and political education courses from ‘courses’ to “educational ecosystems.” The plan proposes opening up ideological and political education courses, fully mobilizing social forces and resources, building “large classrooms,” establishing “large platforms,” and cultivating “high-quality faculty,” so that ideological and political education courses extend beyond schools to society, becoming a large classroom supported by the entire society. On December 27, 2022, the Ministry of Education’s Office issued the “Notice on the Construction of an Integrated Community for Ideological and Political Education in Primary, Secondary, and Higher Education,” requiring provincial-level efforts to establish a set of working mechanisms, incubate a batch of brand-name activities, and create a batch of model “golden courses,” among other measures, to promote the coordinated sharing of course resources, teacher teams, and practical training bases. On May 11, 2024, President Xi Jinping made important instructions on the construction of ideological and political education in schools, emphasizing the need to continue to promote the integrated construction of ideological and political education in primary, secondary, and higher education institutions<sup>[6]</sup>. On July 18, 2024, the “Decision of the Central Committee of the Communist Party of China on Further Deepening Reform and Promoting Chinese-Style Modernization” once again proposed to “improve the mechanism for cultivating virtue and fostering talent, and promote the integrated reform and innovation of ideological and political education in primary, secondary, and higher education institutions,” deepening comprehensive education reform. On January 19, 2025, the Central Committee of the Communist Party of China and the State Council issued the “Outline of the Plan for Building an Education Powerhouse (2024-2035).” Propose to accelerate the construction of a powerful ideological and political education system with strong ideological guidance, comprehensively build a solid foundation for ideological and political education, effectively teach the course “Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era” systematically improve the curriculum standards for ideological and political courses in primary and secondary schools, comprehensively optimize the design of ideological and political course plans in higher education, and promote integrated reform and innovation of ideological and political courses across primary, secondary, and higher education.

At the local level, various provinces and cities have also carried out integrated construction of ideological and political courses in primary, secondary, and higher education institutions in various forms according to local conditions, and have achieved initial results. For example, Guangdong Province has successively issued documents such as the “Guangdong Province Action Plan for the Construction of Ideological and Political Theory Courses in Schools,” “Several Measures for Strengthening the Construction of Marxist Institutes in the New Era” and “Measures for Coordinating the Integrated Construction of Ideological and Political Theory Courses in Primary, Secondary, and Higher Education Institutions” establishing a working mechanism coordinated by the Provincial Party Committee’s Education Work Leading Group, led by the Provincial Party Committee’s Education Work Committee, and jointly promoted by various departments.

Guide universities to establish teaching and research departments for the course “Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era” and deliver high-quality lectures on this course. Implement the “South Guangdong High-Quality Ideological and Political Education Course Construction Program,” and develop a series of high-quality courses such as “The Process of the Sinicization and Modernization of Marxism and the Mission and Responsibilities of Young Students in the New Era” and the “Strengthening the Nation Series” and other high-quality courses, select and build 327 high-quality ideological and political course examples at universities, 174 model course examples for college students’ public lectures on the history of the Party, and cultivate and build 100 high-quality ideological and political courses for primary

and secondary schools and vocational schools. We have improved the four-tier training system at the provincial, municipal, county, and university levels, and established seven training bases for ideological and political education teachers in higher education institutions. We have organized the Provincial Competition on Basic Teaching Skills for Young Ideological and Political Education Teachers in Higher Education Institutions and the Inter-Provincial League Competition among Guangdong, Guangxi, Hainan, Jiangxi, and Yunnan Provinces, among other activities <sup>[7]</sup>.

#### **4. Optimizing the integrated coordination mechanism for ideological and political education courses in primary, secondary, and higher education: A case study of Zhongshan city, Guangdong province**

In August 2023, the Guangdong Province Primary and Secondary School Ideological and Political Education Courses Integration Consortium Project was officially launched, led by Zhongshan Vocational and Technical College and the Zhongshan Municipal Bureau of Education and Sports, with the participation of ideological and political education teachers from the Municipal Teacher Development Center, the Municipal Research Office, Langqing Primary School, the First Middle School of Zhongshan City, the Municipal Modern Vocational School, and researchers from the Learning Support Course Center. Concurrently, the Zhongshan Municipal Bureau of Education and Sports issued the “Notice on the Establishment of the Zhongshan City Integrated Collaborative Mechanism for Ideological and Political Education in Primary, Secondary, and Higher Education Institutions” (Zhong Jiaotong [2024] No. 26), clarifying the guiding principles, personnel composition, and responsibilities for the integrated development of ideological and political education across all levels of education, and establishing a collaborative platform for the integrated mechanism. The project team adheres to the principle of openness in ideological and political education, visiting multiple locations to explore practical bases, and signing agreements with the Zhongshan Museum, Sun Yat-sen’s Former Residence, and other red cultural resources to establish practical bases for the integrated community. Through city-wide home-school-society collaboration, comprehensive training for ideological and political education teachers, model classroom construction, practical case studies, and theoretical research, the team aims to build a “four-dimensional integrated” collaborative mechanism involving family, school, society, and the internet, achieving the core goal of holistic moral education.

##### **4.1. Family: Inheriting excellent traditional Chinese culture and strengthening practical educational scenarios**

The family is the basic cell of society and the first school for every individual, with parents serving as a child’s first teachers. “No matter how times change or how the economy and society develop, for a society, the reliance on family life is irreplaceable, the social functions of the family are irreplaceable, and the civilizing role of the family is irreplaceable” <sup>[8]</sup>. It is clear that the source of moral education and talent cultivation lies in the family. China has a long-standing educational tradition of “family and state as one,” such as emphasizing the progressive education of self-cultivation, family management, and state governance to achieve social stability. Additionally, it emphasizes that “if a child is not educated, it is the father’s fault,” and through behavioral norms such as the “Book of Rites” and the “Classic of Filial Piety,” the concepts of filial piety and brotherly love are repeatedly reinforced in family life. Therefore, in the integrated construction of ideological and political courses in primary, secondary, and higher education in the new era, parents must also actively assume the role of the first educators. The primary school stage is the stage of the emergence and standardization of values. Parents educate their children



in the family through everyday life scenarios. For example, through the modern adaptation of Confucian classics such as “morning reflection and evening reflection” and “brothers being friendly and respectful to each other,” as well as reading together and interactive games, children can form basic values. The secondary school stage is when adolescents develop abstract and critical thinking. Family education can utilize participatory learning methods such as family meetings and community volunteer services to enable children to better understand, participate in, and reflect on social issues, thereby deepening their consensus of core values and forming an initial sense of social responsibility. Additionally, attention should be paid to home-school collaboration in the online space. During the university stage, most young people have left their families and entered university campuses. Parents should transition from “educators” to “consultants.” On one hand, they should continue to encourage their children to complete their studies diligently and actively participate in campus activities. On the other hand, they should also focus on career guidance and life guidance for their children, encouraging them to develop themselves in a broader perspective, ultimately achieving the transition from “family members” to “members of society.”

## **4.2. Schools: Building a multi-dimensional and integrated education system to enhance the effectiveness of ideological and political education courses**

Schools are temples of knowledge, and the ideological and political education and strengthening of students’ minds primarily take place in schools, with classrooms serving as the main venues for ideological and political education.

When making important instructions on the construction of ideological and political education courses in schools, President Xi Jinping emphasized that “we must always uphold the guiding role of Marxism, take the remarkable achievements of socialism with Chinese characteristics as the content foundation, draw strength from the fine traditional culture, revolutionary culture, and advanced socialist culture of China, explain the principles deeply, thoroughly, and vividly, adhere to the essence while innovating, and promote the high-quality development of ideological and political education courses, continuously enhancing their relevance and appeal”<sup>[9]</sup>. As an important link in the integrated construction of ideological and political courses in primary, secondary, and higher education, schools need to build a composite education system from multiple dimensions: In terms of the integration of teaching and course content, it is necessary to establish a scientific and reasonable ideological and political course system through overall planning of ideological and political course objectives, unified textbook compilation, and the establishment of cross-stage thematic discussion courses, so as to achieve smooth connections and spiral advancement of teaching content at all stages of education. In terms of integrated teacher team development, strengthen the coordination and collaboration between local education authorities and integrated development committees, organize joint lesson preparation, teaching observations, and pedagogical training activities, and actively cultivate “1+N” teacher development communities; In terms of integrated teaching resources, strengthen digital infrastructure, enhance the utilization of high-quality resource repositories, such as implementing a credit-based management system for national, regional, and school-based resource repositories. In terms of integrated teaching methods, follow educational laws and the characteristics of students at different educational stages, adopt differentiated teaching methods such as gamified teaching in primary schools, issue-based teaching in secondary schools, and research-based learning in universities, while innovating cross-stage “relay classes”; In terms of integrated evaluation systems, avoid single-dimensional evaluation and establish a diversified scientific evaluation system, such as a dynamic evaluation system that includes knowledge mastery, value recognition, behavioral practice, and developmental growth. Furthermore, we actively integrate

resources from families, society, and the internet to form a collaborative effort, creating a new framework for education that is vertically integrated and horizontally interconnected.

### **4.3. Society: Building a community platform to achieve resource sharing and practical education**

Society is an extension and expansion of family and school education, and it is also a testing ground and application arena for ideological and political education. The effectiveness of ideological and political education is mainly demonstrated and applied in society. The expansion from small classrooms in schools to large classrooms in society is mainly carried out through the following three aspects: first, building a large platform and creating an integrated and coordinated mechanism.

The integration of ideological and political education across primary, secondary, and higher education institutions particularly requires the coordination and guidance of local education administrative departments. For example, specialized institutions for the integration of ideological and political education across primary, secondary, and higher education institutions should be established to provide policy guidance, develop shared platforms, strengthen implementation, and promote outreach and dissemination around integrated content provision, curriculum development, methodological reform, team building, and ideological and political research<sup>[10]</sup>.

Second, design large classrooms and develop integrated curriculum resources. Ideological and political education should not only be taught in the classroom but also in real-life social contexts. By integrating and utilizing social resources, especially those related to ideological and political education, such as museums, memorial halls, historical and cultural sites, science and technology museums, and enterprises, the existing school teaching environment can be enriched and expanded. Teachers can design diverse social practice activities to allow students to deeply experience and observe real-life situations, thereby enhancing their understanding and recognition of the content of ideological and political education courses.

Third, cultivate great teachers and optimize the integrated teaching team. The key to running good ideological and political theory courses lies in the teachers. In addition to the existing team of ideological and political teachers in schools, we should actively invite social forces to participate in the construction of ideological and political courses, such as scientists, educators, heroic models, master craftsmen, and red base interpreters, who can all join the part-time teaching team. For example, we can design programs where heroic role models share their growth experiences, allowing students to appreciate the historical responsibility of being new people of the era who are living in the new era of socialism with Chinese characteristics and called upon to shoulder the great task of national rejuvenation.

### **4.4. Network: Innovating education models and building a new digital ecosystem**

The Internet is the fourth space for the dissemination of knowledge and ideological and political education in modern society. Its unique interactivity and reach provide new possibilities for ideological and political education. Online interactions and online life are essentially extensions of real-life interactions and real life. They shape individuals' values and behavioral patterns in the interplay between the virtual and the real. To achieve the goal of integrated ideological and political education across all levels of education, the online space must also be co-constructed. First, create a positive online atmosphere and culture. "The online space should be clear and healthy, with a good ecological environment that serves the interests of the people"<sup>[11]</sup>. By optimizing the content supply of online works, ensure that the information content in cyberspace is healthy, positive, and in line with socialist core values. Allow students to absorb positive energy in cyberspace. Second, utilize the internet to innovate and

reconstruct teaching models. For example, carry out blended online and offline teaching, utilize cyberspace for flipped teaching, resource sharing, etc., to enhance the appeal and influence of ideological and political education courses. Third, establish online interactive platforms for schools, families, and communities, and build online co-education platforms to jointly discuss the content and arrangements of ideological and political education courses.

Under the strategic deployment of the Party's 20th National Congress on the "three-in-one" strategy of education, science and technology, and talent, the construction of a coordinated mechanism for the integrated development of ideological and political education in primary, secondary, and higher education institutions should follow the logic of systems theory. Families should consolidate the foundation of values through the modern transformation of traditional cultural genes, schools should strengthen the effectiveness of the main channel through multi-dimensional collaborative innovation, society should construct and expand the temporal and spatial dimensions of education through practical platforms, and the internet should reshape the educational ecosystem through technological innovation. These four mechanisms, while differing in their functional roles, share common value objectives, forming a closed-loop collaborative education system where families lay the foundation, schools consolidate the core, society refines, and the internet empowers, providing a practical pathway for the high-quality development of ideological and political education in the new era.

## 5. Conclusion

Based on the analysis of the historical origin, research status and current challenges of the integrated construction of ideological and political education courses in primary, secondary, and higher education institutions, this study has distilled a "four-dimensional integrated" collaborative path from the case of Zhongshan City, Guangdong Province. The research shows that constructing a multi-dimensional education system that integrates family culture infiltration, school system collaboration, social resource linkage, and network ecological reconstruction is an effective way to solve the structural contradictions, such as the academic stage fragmentation and field separation existing in traditional ideological and political education.

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# The Application Path of the Blended Differentiated Teaching Model in International Chinese Teaching

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**Abstract:** As an organic combination of blended teaching model and differentiated teaching model, the blended differentiated teaching model can not only effectively break through the time and space limitations in the offline implementation of differentiated teaching, truly extend the classroom to online platforms, but also help students build personal learning resource libraries and promote personalized learning. Taking the international Chinese course teaching as an example, this paper focuses on exploring the specific application paths of the blended differentiated teaching model in this course. It aims to fully arouse students' learning interest, enhance learning effects, meet the diversified needs of international Chinese teaching, significantly improve teaching quality, and effectively provide new ideas and practical support for the reform and innovation of international Chinese teaching.

**Keywords:** Blended differentiated teaching model; International Chinese teaching; Application path

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## 1. Introduction

With the gradual increase in the number of people learning Chinese, the learner groups have gradually shown diverse characteristics, such as diverse cultural backgrounds, different learning motivations, and varying language foundations. This has brought unprecedented challenges to international Chinese teaching. The traditional “one-size-fits-all” teaching model is obviously unable to meet the personalized and diversified learning needs of all students. This will not only directly affect the quality of students' learning, but also may dampen their interest in learning, resulting in unsatisfactory teaching effects. Therefore, with the upsurge of “Internet + education”, the mixed differentiated teaching model has gradually come into people's vision and slowly penetrated all aspects of international Chinese teaching. It aims to effectively integrate the advantages of online and offline teaching based on students' individual differences, provide students with a more flexible and personalized learning environment, to effectively solve the long-standing problems in international Chinese teaching and promote the reform,



innovation, and development of international Chinese teaching.

## **2. Current status of international Chinese teaching**

For a long time, international Chinese teaching has been mainly conducted offline, with teaching activities organized through teacher-student and student-student interactions in classroom settings. Consequently, relevant research on international Chinese teaching has primarily focused on traditional teaching models. In terms of curriculum design, most arrangements are centered around the physical classroom environment. Meanwhile, textbook content rarely incorporates online teaching elements, and teachers usually do not assign online learning tasks to students. Regarding teaching and learning theories, scholars' research has mostly concentrated on traditional classroom scenarios. Studies on teacher training and development have also mainly focused on improving teachers' instructional skills in traditional classrooms, with less attention paid to enhancing their online teaching capabilities<sup>[1]</sup>. Typically, teachers adopt a model of “centralized lectures + in-class practice + interactive consolidation” to help students understand and master knowledge points. Although such teaching models can meet the learning needs of most students, as the scale of international Chinese teaching continues to expand, its drawbacks have become increasingly evident.

In recent years, with the deepening integration of information technology and education, the blended teaching model has gradually permeated international Chinese teaching due to its advantage of effectively integrating online and offline teaching. However, due to insufficient experience and inadequate teaching capabilities in this area, teachers face the following problems in the practical application of online-offline blended teaching models: Firstly, teachers neglect students' individual differences. College students from different countries have significant cultural differences, which means their learning processes will not be smooth. Secondly, the repetition of teaching content between online and offline sessions may restrict the effective stimulation of students' learning interest, resulting in unsatisfactory learning outcomes in both online and offline settings. Thirdly, the utilization of resources is simplistic<sup>[2]</sup>. Despite the abundance and diversity of online resources, some teachers merely limit their use to uploading teaching materials to online platforms and assigning independent preview tasks to students, rarely designing personalized teaching activities based on students' varying learning needs. This may hinder the full utilization of high-quality resources. In addition, the effectiveness of international Chinese teaching may be directly affected by multiple factors, such as cultural background and learning habits. Some scholars have actively explored differentiated teaching methods to cater to the personalized learning needs of students from different countries<sup>[3,4]</sup>.

## **3. Application paths of the hybrid differentiated teaching model in international Chinese teaching**

The hybrid differentiated teaching model is an organic combination of the blended teaching model and the differentiated teaching model. Specifically, it means that teachers flexibly use various modern information-based teaching methods in all teaching links before, during, and after class, while closely integrating online and offline teaching. Moreover, they need to carefully organize teaching according to students' different learning styles, interests, etc., to provide students with a good personalized learning platform and space, and achieve a twice-the-result-with-half-the-effort teaching effect<sup>[5]</sup>.

### 3.1. Pre-class experience

Before class, teachers not only distribute guided learning plans to students through online platforms and share learning resources with them, but also conduct targeted online Q&A sessions for the problems students encounter during pre-class preview, aiming to create a personalized learning environment for students and make full preparations for the subsequent formal classroom teaching. Specifically, first of all, teachers will build a class-shared learning resource library through online platforms, aiming to provide students with diversified learning materials in addition to traditional textbooks to support them in completing pre-class preview tasks with high quality. This resource library not only allows students to view and download rich learning materials anytime and anywhere, but also encourages them to upload high-quality learning resources independently, thus forming a good atmosphere of co-construction and sharing of learning resources between teachers and students, and among students. For example, students can collect and upload learning resources related to international Chinese courses to the resource library to provide vivid materials for other students<sup>[6,7]</sup>.

Secondly, in the guidance link, teachers will formulate personalized learning guidance plans and release them regularly on the cloud class every Monday and Wednesday. The guided learning plans are based on the teaching syllabus of international Chinese courses, and at the same time, skillfully integrate high-quality course resources from China University MOOCs and other materials for students to watch, providing them with diversified learning choices. In addition to the materials provided by teachers, students can also build personalized learning material libraries according to their own learning needs. To meet the learning needs of students with different foundations, teachers will fully consider students' individual differences when selecting materials. For example, for Korean students with weak Chinese character foundations, teachers will push MOOC videos with double subtitles of pinyin and Korean letters to help them quickly adapt to the Chinese character learning environment and effectively overcome language understanding barriers; for Korean students with a certain Chinese character foundation, teachers can provide them with MOOCs with trilingual subtitles including Korean, pinyin, and Chinese, to help them consolidate their knowledge of Chinese characters and meet their diversified and personalized learning needs<sup>[8]</sup>.

### 3.2. In-class learning and practice

As an important link to deepen students' learning effects, teachers should play key roles such as "instructors" and "assistants" in the in-class learning and practice link. In weekly in-person classes, teachers will not only systematically check students' online learning results and understand their preview situation, but also use discussion areas, online instant messaging tools, etc., to timely reply to a series of problems that students may encounter in the learning process. In actual classes, teachers will skillfully design problem chains around the teaching content to guide students to think deeply about problems, making them the masters of the classroom, while teachers will make supplementary explanations or give tips at key points according to students' answers<sup>[9]</sup>. Taking the teaching of the grammatical structure of "ba" sentences as an example, first, teachers can design a series of questions from easy to difficult for students to think independently or explore in groups, then encourage students to correct each other's mistakes and make sentences in life-like situations, so as to deepen students' understanding of the grammatical structure of "ba" sentences and lay a solid foundation for their subsequent practical application<sup>[10,11]</sup>. After basically completing the explanation and practice of knowledge points, teachers will divide students into several groups according to their differences and carefully design a series of individual or group activities to fully stimulate students' learning interest, while respecting their cultural differences and interests. For example, for students with strong independent learning ability, teachers can carefully assign

individual tasks, such as Chinese character calligraphy copying, Chinese short essay creation, etc.; for students who are good at team cooperation, teachers should carefully design a series of team cooperation activities, such as Chinese debate competitions, situational drama performances, etc. <sup>[12]</sup>

### **3.3. After-class consolidation**

The after-class consolidation link, as an important part of the learning chain, should not be ignored by teachers and students. In this link, in addition to assigning basic consolidation exercises to students, teachers should also design personalized practice tasks for them and provide expanded learning materials to meet students' personalized learning needs. For example, for some students with strong language ability and great interest in Chinese culture, teachers should push a series of relevant materials through online platforms and carefully design discussion questions; for students with a weak Chinese foundation, teachers should focus on helping them consolidate basic grammar and knowledge, and push supporting exercises and targeted intensive training audio <sup>[13]</sup>. Moreover, according to students' interests and based on their learning progress, teachers can encourage students to independently design after-class tasks, such as making Chinese learning handwritten newspapers or recording Chinese learning short videos, which can fully stimulate students' subjective initiative in learning and improve their learning efficiency. As an important part of the after-class consolidation link, evaluation should also actively implement the hybrid differentiated teaching model. Teachers should effectively break through the previous single score-oriented evaluation model and build a diversified and three-dimensional evaluation system to consider students' Chinese proficiency test scores, and at the same time, evaluate students' learning effects and teachers' teaching effects from multiple dimensions, such as students' learning attitude, learning interest, cooperation ability, innovation ability, and classroom participation. Only in this way can a scientific basis be provided for the adjustment and optimization of subsequent teaching strategies, ensuring that the evaluation results are comprehensive and objective, and finally achieving the teaching purpose of promoting learning and reform through evaluation <sup>[14,15]</sup>.

## **4. Conclusion**

To sum up, the application of the hybrid differentiated teaching model in international Chinese teaching not only helps to significantly enhance students' learning interest and improve the efficiency of offline classes, but also effectively narrows the gap in learning levels among students, enhances the overall teaching quality of international Chinese courses, and promotes the achievement of personalized teaching goals. However, the widespread application of the hybrid differentiated teaching model also faces potential challenges. For example, teachers need to simultaneously possess information-based teaching capabilities, cross-cultural sensitivity, and differentiated teaching design literacy, which places higher requirements on teacher training. Some students, due to weak autonomous learning abilities or limitations in technical conditions, find it difficult to adapt to online learning sessions, which may lead to a polarization of teaching effects. Additionally, the development and maintenance of high-quality teaching resources require substantial investment in human and financial costs.

In the future, the reform of international Chinese teaching should be continuously deepened in the following aspects: First, construct a supportive system for the collaborative development of "teachers-platform-students", forming a positive interaction through regular teacher training, optimization of intelligent learning platforms, and cultivation of students' autonomous learning abilities. Second, strengthen empirical research, track students' learning trajectories with the help of big data analysis technology, and dynamically adjust teaching strategies.



Third, promote interdisciplinary cooperation, draw on achievements from fields such as educational technology and cognitive psychology, and continuously improve the theoretical framework and practical paths of the hybrid differentiated teaching model. Only in this way can we truly realize the educational ideal of “teaching students in accordance with their aptitude” and provide more efficient and inclusive learning experiences for Chinese learners worldwide.

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# Reform in Practical Teaching of Internet of Things Engineering Based on Loongson

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**Abstract:** Aiming at the problems existing in the current practical teaching of Internet of Things engineering, such as the dependence of hardware platforms on foreign chips and the disconnection between teaching content and industrial needs, this paper proposes a teaching reform scheme based on the domestic Loongson processor. Through the construction of a Loongson Internet of Things experimental platform, the development of supporting teaching resources, and the optimization of the practical curriculum system, the in-depth application of domestic technologies in teaching has been realized. Practice shows that this reform scheme has effectively improved students' independent innovation ability and application ability of domestic chips, providing a new path for cultivating Internet of Things engineering and technical talents that meet the national strategic needs.

**Keywords:** Loongson processor; Internet of Things engineering; Practical teaching; Teaching reform; Domestic technology

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## 1. Introduction

With the rapid development of Internet of Things (IoT) technology, talent cultivation in related fields is facing new opportunities and challenges <sup>[1]</sup>. Currently, universities generally adopt development platforms based on foreign chips for IoT engineering practice teaching, which have problems such as strong technical dependence and lagging updates in teaching content <sup>[2,3]</sup>. At the same time, the country is vigorously promoting the innovation industry of information technology application, creating an urgent demand for talent cultivation related to domestic chips. This study reconstructs the IoT practice teaching system based on the Loongson processor, aiming to explore a teaching reform path that meets national strategic needs. By analyzing the shortcomings of the existing teaching model and combining the technical characteristics of Loongson, a complete teaching reform plan is designed, and its effectiveness is verified in actual teaching.

## 2. Analysis of the current situation of IoT engineering practice teaching

There are three main problems in the current IoT engineering practice teaching: strong dependence on hardware platforms, lagging teaching content, and insufficient practical ability of students<sup>[4-6]</sup>. Most colleges and universities adopt experimental equipment based on ARM or Intel architectures. These foreign chips dominate the market, leading to a deviation between teaching and domestic industrial needs<sup>[7,8]</sup>. At the same time, the update speed of practical courses is slower than the development of technology, and most experimental projects are verification-oriented, lacking innovative design links. Surveys show that more than 60% of IoT major graduates report a gap between the skills they have learned and the needs of enterprises, especially their weak ability in the application of domestic chips.

Combined with cases from multiple colleges and universities, the specific manifestations of the core problems in IoT practice teaching are summarized in **Table 1**.

**Table 1.** Specific manifestations of core problems

Problem dimensions	Specific manifestations
Hardware conditions	Outdated laboratory equipment, low software operation efficiency in public computer rooms, and a shortage of expandable equipment such as IoT sensors
Course content	Emphasis on traditional embedded development (such as STM32), lack of cutting-edge modules such as domestic chip adaptation and security encryption
Teacher competence	Teachers have insufficient practical experience in enterprises, making it difficult to guide students in solving development and debugging problems in the Loongson ecosystem
Integration of industry and education	School-enterprise cooperation remains at the level of cognitive internships, failing to form a closed loop of “research - learning - application”

This paper proposes a practical teaching reform plan with the domestic Loongson processor as the core. By reconstructing the curriculum system, building a Loongson IoT experimental platform, and deepening school-enterprise collaboration, a three-stage ability training path of “foundation - integration - innovation” is constructed, providing a promotable paradigm for the training of domestic independent and controllable technical talents.

## 3. Practice teaching reform plan for Internet of Things based on Loongson

The reform plan proposed in this study includes three core contents: the construction of the Loongson Internet of Things experimental platform, the development of teaching resources, and the optimization of the curriculum system<sup>[9]</sup>. The experimental platform adopts the Loongson 1C300 processor as the core, matched with independently developed sensor modules and communication interfaces, supporting multiple IoT protocols such as LoRa and Zigbee. In terms of teaching resource development, a series of textbooks such as “Loongson Internet of Things Development Tutorial” has been compiled, and a resource library containing 30 typical experimental projects has been established. The curriculum system adopts a three-level structure of “basic-integrated-innovative”, organically combining the characteristics of Loongson technology with IoT engineering knowledge, and emphasizing the cultivation of system design and problem-solving abilities<sup>[10-13]</sup>.

### 3.1. Curriculum system reconstruction: layered empowerment of domestic technology stack

(1) Basic layer: Add the compulsory course “Loongson Processor Architecture and Instruction Set” to

replace the traditional single-chip microcomputer course.

- (2) Integrated layer: Develop experimental modules for the Loongson cloud platform (communication protocols + sensor data collection + AI + containerization), and offer comprehensive training projects such as “smart agriculture and industrial Internet of Things”;
- (3) Innovation layer: Based on the needs of enterprises in the Loongson ecosystem, offer innovative training projects such as “Loongson + RISC-V heterogeneous computing, digital twin simulation system, and AIoT federated learning framework.”

**Table 2** shows the design of 30 typical experimental projects in the “Internet of Things Development Tutorial” based on Loongson processors, covering a complete learning path from basic to comprehensive applications, highlighting the characteristics of domestic technologies and the cultivation of engineering practice capabilities.

**Table 2.** Design of 30 typical experimental projects

Experiment type	Experiment project	Experiment content
Basic Development Experiments (1-8)	1. Construction of Loongson Development Environment	Loongnix system installation, cross-compilation toolchain configuration, serial port debugging
	2. GPIO-controlled LED Breathing Light	Adjust brightness through PWM and master Loongson GPIO register operations
	3. UART Serial Communication Experiment	Realize data transmission between Loongson and PC, and parse the Modbus protocol
	4. I2C Temperature and Humidity Sensor Driver	Write SHT30 sensor driver, data collection and calibration
	5. SPI Interface OLED Display	Drive 0.96-inch OLED to display sensor data
	6. Timer Interrupt Application	Use Loongson hardware timer to achieve accurate data sampling
	7. ADC Illumination Intensity Detection	Photosensitive resistor analog signal collection and digital processing
	8. Watchdog and System Reliability	Configure hardware watchdog to prevent program runaway
Communication Protocol Experiments (9-16)	9. LoRa Wireless Networking	Build a star network of Loongson + LoRa modules, RSSI testing
	10. Zigbee Ad Hoc Network Communication	Coordinator and terminal node communication, network topology analysis
	11. MQTT Protocol Cloud Connection	Connect to domestic MQTT Broker (such as EMQX), publish and subscribe to messages
	12. HTTP RESTful API Development	Develop API based on Loongson lightweight web server (such as Tinyhttpd)
	13. Bluetooth BLE Data Transparent Transmission	Loongson acts as a Central device to scan and receive sensor data
	14. 4G Cat.1 Module Networking	Upload data to the cloud platform through domestic 4G modules (such as Quectel EC200)
	15. National Secret Algorithm Encrypted Transmission	SM4 encrypts sensor data, SM2 digital signature verification
	16. Multi-Protocol Gateway Conversion	Realize Zigbee to Wi-Fi protocol conversion (requires supporting protocol stack)

**Table 2 (Continued)**

Experiment type	Experiment project	Experiment content
Comprehensive Application Experiments (17-25)	17. Smart Agriculture Monitoring System	Soil moisture + light + CO2 multi-sensor fusion, LoRa backhaul
	18. Industrial Vibration Monitoring Terminal	Acceleration sensor data FFT analysis, edge computing early warning
	19. Smart Street Light Control System	Light control + remote dimming + energy consumption statistics (adapted to domestic PLC protocol)
	20. RFID Asset Management System	Loongson drives 13.56MHz card reader, data encryption storage
	21. Speech Recognition Edge Terminal	Port lightweight ASR model (such as Kaldi) to Loongson platform
	22. AI Camera Target Detection	USB camera + YOLOv3-tiny model deployment (OpenCV adaptation)
	23. OTA Remote Upgrade System	Differential upgrade package generation and security verification (national secret SM3 hash)
	24. Containerized Application Deployment	Run Docker containers on Loongson platform (requires adaptation to MIPS architecture)
	25. Energy Monitoring and Optimization	Electric energy metering chip driver + load dynamic scheduling algorithm
Innovation Expansion Experiments (26-30)	26. Loongson + RISC-V Heterogeneous Computing	Loongson as the main control, connecting RISC-V coprocessor through SPI
	27. OpenHarmony OS Porting	Porting of OpenHarmony lightweight system on Loongson 1C300
	28. Digital Twin Simulation System	Loongson data docking with Unity3D/domestic Web3D engine
	29. AIoT Federated Learning Framework	Multi-Loongson terminal collaborative training of lightweight models
	30. National-wide Localization Certification Experiment	Full-stack localization compatibility testing from chips, OS to applications

### 3.1.1. Features of this IoT engineering experiment design

- (1) Gradient Progression: From register operations to system-level design, covering the entire IoT technology stack.
- (2) Domestic Integration: 60% of the experiments involve national cryptographic algorithms, domestic operating systems, or domestic cloud platforms.
- (3) Integration of Virtual and Physical: Supporting simulation tools (Loongson QEMU image) to reduce hardware dependency.
- (4) Industry Alignment: Experimental cases refer to real scenarios such as smart homes and industrial Internet.
- (5) Open-Source Support: Providing code repositories and hardware design references maintained by the Loongson community.

### 3.2. Construction of the Loongson Internet of Things laboratory

- (1) Hardware configuration: Loongson 1C300 development board + domestic sensor modules + LoRa gateway, supporting the Loongnix operating system.



- (2) Virtual expansion: Establish a Loongson cloud experiment platform to address the bottleneck of the number of physical devices.
- (3) Laboratory construction: Build an IoT engineering practice laboratory based on Loongson, equipped with corresponding hardware devices and software tools to provide students with a good practical environment.
- (4) Virtual simulation experiments: Utilize virtual simulation technology to develop a Loongson-based IoT virtual simulation experiment platform, allowing students to conduct experiments and practices in a virtual environment, thereby improving the safety and efficiency of experiments.

### 3.2.1. Features of laboratory equipment

- (1) Teaching + training: Based on the goals and methods of talent cultivation for IoT majors in vocational colleges, optimize and design the training teaching. It puts forward the teaching concept of progressing from the cognition of IoT knowledge and technology, to the training of IoT practical skills, and finally to the improvement of professional post capabilities in the IoT field.
- (2) Comprehensive technical coverage: The design will integrate as many mainstream IoT devices or technologies as possible into the system, including sensor technology, data acquisition technology, radio frequency identification technology, wireless network technology, mobile Internet technology, embedded technology, intelligent terminal technology, upper computer application software technology, etc. It covers all relevant technical fields of the IoT completely and comprehensively.
- (3) Wide range of applications: The system takes three application scenarios of IoT, artificial intelligence, and cloud computing, as well as various business sub-items based on these three scenarios, to reflect the theme of IoT smart life. All application scenarios and functional business sub-items are selected from real IoT industry applications.
- (4) Easy expansion: The hardware and software systems adopt platform-based and modular design, combined with generalized and standardized IoT training workstations. In addition to completing the demonstration and training of supporting training content, more technologies or businesses can be connected and expanded based on the IoT training workstations and the system's hardware and software modules.
- (5) Complete supporting facilities: In addition to the complete hardware and software system, the product is also equipped with a complete IoT training guide for the equipment, rich teaching and training material resources, and IoT teaching video CDs based on the equipment system. The experimental equipment comes with free installation and deployment services and equipment training services.

### 3.3. School-enterprise collaborative “Four-Dimensional Driving” model

**Table 3.** Dimensions and implementation strategies in the model

Dimension	Implementation strategies
Industry	Enterprises donate Loongson development kits and jointly release practical training projects.
Learning	Engineers are stationed in the school to guide the debugging of the Loongson platform and participate in the guidance and evaluation of graduation projects.
Research	Teachers and students undertake horizontal projects from enterprises (such as optimization of Loongson edge computing gateways).
Application	Students' achievements are implemented in communities/campuses (such as the Loongson smart manhole cover monitoring system).

### **3.4. Upgrading of teachers' competence**

- (1) Teachers go to Loongson-related research institutions for further study on domestic chip development technology and obtain LoongArch certification;
- (2) Engineers from Loongson-related enterprises are hired as teachers for practical courses in Internet of Things engineering.

## **4. Implementation of teaching reform and effect evaluation**

### **4.1. Adjustment of teaching content**

Integration with Loongson characteristics: Conduct in-depth research on the architecture, performance, and features of Loongson processors, and integrate them into the teaching content of Internet of Things (IoT) engineering. For example, when explaining the construction of IoT hardware platforms, introduce Loongson-based development boards to enable students to learn about hardware selection, circuit design, and system integration based on Loongson.

### **4.2. Update of knowledge system**

Keep up with the development trends of IoT technology and Loongson technology, and promptly update teaching content to ensure students master the latest technologies and applications. For instance, add application cases and technical explanations of Loongson in IoT security, edge computing, and other fields.

### **4.3. Improvement of teaching methods**

- (1) Project-driven teaching: Design IoT engineering projects based on Loongson, allowing students to participate in project practice in groups. They will experience the entire project implementation process from requirement analysis, design, development to testing, thereby improving their practical abilities and teamwork skills.
- (2) Integration of practical operations and theoretical teaching: On the basis of theoretical teaching, increase practical operation sessions to help students deepen their understanding and mastery of theoretical knowledge through hands-on practice. For example, when explaining IoT communication protocols, let students implement protocol programming and debugging on Loongson-based development platforms.

### **4.4. Strengthening the construction of teaching staff**

- (1) Training and learning: Organize teachers to participate in Loongson-related training and learning activities to improve their professional level and practical capabilities, enabling them to better carry out Loongson-based IoT engineering practice teaching.
- (2) Enterprise cooperation: Encourage teachers to cooperate with enterprises, participate in enterprise project development and technical research, understand the latest industry needs and development trends, and bring practical enterprise experience into classroom teaching.

### **4.5. Evaluation of students' learning effects**

- (1) Mastery of knowledge: Evaluate students' mastery of Loongson-based IoT engineering knowledge through examinations, assignments, and experimental reports.
- (2) Improvement of practical abilities: Observe students' performance in project practice to assess the



improvement of their practical operation skills, problem-solving abilities, and innovative capabilities.

- (3) Learning satisfaction: Understand students' satisfaction with teaching content, teaching methods, and practical teaching environment through questionnaires and student forums.

#### **4.6. Evaluation of teaching quality**

- (1) Achievement of teaching objectives: Compare teaching objectives before and after the teaching reform to evaluate their achievement, and verify that the practical teaching reform has effectively improved teaching quality.
- (2) Teaching effectiveness of teachers: Evaluate teachers' teaching effectiveness through student evaluations and peer reviews to understand their performance and existing problems in the teaching process.

#### **4.7. Evaluation of social feedback**

- (1) Employment situation: Track the employment status of graduates, understand the employment proportion and quality of graduates in Loongson-based IoT engineering-related fields, and evaluate the effect of the teaching reform on enhancing students' employment competitiveness.
- (2) Enterprise feedback: Communicate with cooperative enterprises to understand their evaluations and feedback on graduates, obtain their suggestions and opinions on the teaching reform, and provide references for further improving teaching.

The reform plan has been implemented in the IoT engineering major of our university for two academic years, covering 4 classes with a total of 120 students. Data were collected through various methods such as questionnaires, skill tests, and project evaluations. The results show that students' ability to apply domestic chips has improved significantly, with proficiency in Loongson platform development reaching over 85%; their innovative practical abilities have been significantly enhanced, completing 20 innovative projects, 5 of which won provincial competition awards. Compared with traditional teaching classes, the experimental group students have an average improvement of 30% in system design ability and problem-solving ability. Enterprise feedback indicates that graduates participating in this project are more adaptable to the domestic technical environment, with a 25% increase in job matching.

### **5. Conclusion**

The teaching reform of Internet of Things (IoT) engineering practice based on Loongson processors has proven that the application of domestic chips in teaching can effectively improve the quality of talent cultivation and meet the needs of the national strategy for innovation in information technology application<sup>[14,15]</sup>. Future research will further expand the scope of implementation, optimize curriculum content, strengthen school-enterprise cooperation, and develop more typical application cases based on Loongson. Meanwhile, it will explore the integrated application with other domestic technologies, build a more complete independent innovation practice teaching system, and provide continuous support for cultivating high-quality IoT engineering and technical talents.

### **Disclosure statement**

The author declares no conflict of interest.

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# Innovation and Optimization Paths of Teaching Archives Management by Teaching Secretaries in Higher Vocational Colleges Based on Artificial Intelligence

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**Abstract:** With the rapid development of artificial intelligence technology, its application in the field of teaching archives management in higher vocational colleges is continuously deepening. Based on this, this paper conducts an in-depth exploration of the development trends of intelligent management and optimization of teaching archives in higher vocational colleges, as well as the application strategies for intelligent management and optimization of teaching archives in higher vocational colleges based on artificial intelligence. The purpose is to achieve better management of teaching archives and provide certain references for relevant researchers.

**Keywords:** Artificial intelligence; Teaching secretary; Higher vocational colleges; Intelligent management of teaching archives

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## 1. Introduction

With the in-depth advancement of the construction of a socialist country under the rule of law and the implementation of the newly revised Archives Law, whose supporting role has become more prominent, the development of the archives cause is in an important period of strategic opportunities. At the same time, it is also facing severe challenges, which urgently require deepening the governance of archives in accordance with the law and improving the capacity and level of archives governance. The people's living standards have been significantly improved, and their demand for archive information and archive culture is growing, which urgently requires accelerating the opening of archives, expanding the use of archives, and providing high-quality and efficient services. The wide application of a new generation of information technology has brought about tremendous changes in the working environment, objects, and content of archives, which urgently require innovating the concepts, methods, and models of archive work, and accelerating comprehensive

digital transformation and intelligent upgrading. There are conceptual obstacles, institutional defects, technical bottlenecks, and talent shortages that restrict the high-quality development of archive work. Problems such as unbalanced development between regions and industries, and insufficient archive utilization services remain prominent, and there are still weak links in grassroots work. It is necessary to improve the management system and working mechanism compatible with the implementation of the newly revised Archives Law, enhance the overall planning and guidance and coordination capabilities of archive authorities at all levels, and strengthen the capacity building of grass-roots archive institutions in performing their duties <sup>[1]</sup>. Teaching secretaries, as an important position in the management of grass-roots teaching archives, need to continuously align with the standards of standardized archive management, possess certain professional knowledge of archives and modern archive management skills, innovate the concepts of archive work, and empower archive management with modern information technology.

## **2. Development trends in intelligent management and optimization of teaching archives in higher vocational colleges**

### **2.1. Transformation of management models**

In terms of changes in management models, the traditional manual-based management model with paper archives as the carrier is gradually being replaced by intelligent and automated management models <sup>[2]</sup>. In the collection phase of archives, artificial intelligence technology can automatically classify, code, and label various teaching documents (such as teachers' teaching calendars, lesson plans, students' process-based assignments, and course assessment materials) through intelligent recognition technology. This enables rapid and accurate initial organization, greatly reducing the workload of teaching secretaries. In terms of storage, cloud computing and big data technologies not only provide secure and stable cloud storage space for massive teaching archives but also break the spatial and temporal limitations of traditional storage, allowing teaching archives to be accessed and retrieved anytime and anywhere. Intelligent retrieval systems, powered by natural language processing technology, enable teachers and students to find relevant content through simple descriptions and have it presented directly <sup>[3]</sup>. Additionally, based on the big data analysis functions of intelligent educational administration systems and online course platforms, teaching secretaries can analyze students' grade distributions, score fluctuations, the rationality of curriculum settings, and satisfaction levels. This provides a basis for teaching reforms and the formulation of talent training programs, realizing a shift from passive management to active management <sup>[4]</sup>.

### **2.2. Diversification of management**

On the one hand, management subjects are becoming diversified. Artificial intelligence and big data platforms can provide different presentation methods for teachers, students, and teaching management departments outside the school's archives department. Specifically, teachers can upload teaching materials in a timely manner, share teaching experiences, and participate in the evaluation and feedback of teaching archives through intelligent management systems, providing first-hand information for improving the archives of secondary colleges. Students can upload and store archives such as learning outcomes and internship reports, enabling teaching secretaries to better understand the implementation of teaching activities during this period. Teaching secretaries can also better integrate materials from teachers and students to communicate effectively with teaching management and evaluation departments. Teaching management and evaluation departments, in turn,

can conduct macro management and overall planning based on teaching archives and issues summarized by teaching secretaries, thereby ensuring the high-quality operation of teaching in higher vocational colleges <sup>[5]</sup>. On the other hand, management content is becoming diversified. The storage forms of teaching archives are no longer limited to traditional text materials but also include images, audio, video, and other formats. For example, teaching secretaries can use intelligent management systems to collect students' internship videos, photo materials, and materials related to vocational skills competitions, while also storing conventional teaching archives. Furthermore, diversified intelligent archive management can not only better assist teachers and school administrators in their daily work but also guide the formulation and implementation of talent training programs and teaching plans, ensuring the smooth progress of teaching work <sup>[6]</sup>.

### **2.3. Systematization of management**

Higher vocational colleges can gradually improve their archive management platforms and establish a teaching archive management system covering all links, including collection, organization, storage, utilization, and security assurance. In terms of system construction, a unified teaching archive management platform should be built to achieve data intercommunication and sharing between different departments and systems, break information silos, and improve the overall efficiency of archive management. At the same time, higher vocational colleges should focus on the compatibility and scalability of the system, enabling continuous upgrades and improvements in line with technological development and changes in school needs. In terms of security assurance, higher vocational colleges can adopt advanced encryption technologies, access control technologies, and other functions to ensure the confidentiality, integrity, and availability of teaching archives. They should also establish sound security management systems and emergency plans to prevent and respond effectively to potential security risks. In addition to the above aspects, higher vocational colleges need to strengthen the training and education of teaching archive management personnel, improve their professional literacy and information technology application capabilities, and enable them to proficiently master the operation and maintenance of various intelligent management platforms <sup>[7]</sup>.

## **3. Application strategies for intelligent management and optimization of teaching archives in higher vocational colleges based on artificial intelligence**

### **3.1. Intelligent collection**

In traditional teaching archives management, teaching secretaries have long faced the problem of “emphasizing collection over analysis”. That is, they need to spend a lot of time dealing with basic tasks such as processing paper archives, classifying electronic documents, and updating data spreadsheets, making it difficult for them to get away from complex repetitive work, which affects the timeliness and accuracy of teaching management work. The emergence of artificial intelligence technology has freed teaching secretaries from complex mechanical operations, allowing them to shift their focus to more meaningful things. At the data collection level, the system achieves comprehensive recording of teaching activities through the in-depth integration of IoT devices and teaching platforms. For example, there is no need for manual attendance statistics; instead, student attendance reports can be automatically generated with the help of classroom access control devices and online check-in systems. Documents such as teaching plans, course syllabi, and lesson plans submitted by teachers can also be converted into structured data and corresponding course files through OCR recognition technology. Information such as course adjustments, make-up exams, and retakes can be counted and exported through the intelligent



academic affairs system. Teaching secretaries can build a three-dimensional data collection for students through various big data platforms, thereby laying the foundation for subsequent storage and analysis <sup>[8]</sup>.

### **3.2. Intelligent organization**

Teaching secretaries and related teaching staff can use artificial intelligence technology to empower the management of teaching process materials, and conduct in-depth analysis of the system's archive data through semantic analysis models. Firstly, through semantic analysis of various data such as course syllabi, lesson plans, and courseware, artificial intelligence can sort out the shifting direction of teachers' teaching focuses, the innovation of teaching methods, and the expansion direction of knowledge points, thereby forming dynamic student ability maps and better promoting teaching reform <sup>[9]</sup>. Secondly, in terms of integrating course resources, artificial intelligence can real-time monitor the updated information of course teaching versions and corresponding changes in teaching resources; that is, it can track the revision records of teaching syllabi, talent training programs, updated content of multimedia courseware, and adjustments to internship and training guidance plans. Thirdly, by analyzing students' make-up exam and retake rates, artificial intelligence enables teaching secretaries to intuitively identify which courses have consistently high make-up and retake rates due to unreasonable difficulty settings or assessment methods. Teaching secretaries also use data analysis tools to explore the hidden value information in teaching archives, thereby providing a certain scientific basis for teaching decision-making and promoting the transformation of teaching management in higher vocational colleges from experience-driven to data-driven <sup>[10]</sup>.

### **3.3. Intelligent management**

In terms of information security protection, traditional methods rely on static risk prevention measures such as firewalls and antivirus software, which are difficult to cope with increasingly complex network attacks and internal irregular operations. Artificial intelligence management conducts real-time monitoring and analysis of multi-source data, such as teaching secretaries' behaviors, network traffic, and system logs through the system's machine learning algorithms <sup>[11]</sup>. For example, when a teaching secretary attempts to access data unrelated to their work during non-working hours, artificial intelligence technology will automatically use homomorphic encryption technology to encrypt the archive content, ensuring the security of data during storage and transmission. In terms of archive repository management, teaching secretaries used to manually number and store archives, which was prone to omissions and often resulted in problems such as being unable to find required materials. With artificial intelligence technology, teaching secretaries can add a unique number, i.e., a digital tag, to the content of physical archive management. With the help of intelligent search software such as "Everything", they can retrieve the location of archives through keyword searches, facilitating better archive retrieval <sup>[12]</sup>. It can be seen that artificial intelligence technology has brought dual improvements in security protection and intelligent management to the intelligent management and optimization of teaching archives.

### **3.4. Intelligent service and utilization**

The job responsibilities of teaching secretaries require them to organize and file teaching documents, manage various archive materials of the school, including teaching plans, syllabi, class schedules, student grades, and archives etc. They also need to collect, organize, and store teaching materials, and be responsible for the collection, organization, filing, and transfer of various documents generated in daily teaching management. Artificial intelligence technology enables teaching secretaries to access relevant content anytime and anywhere,

facilitating their daily work. Intelligent collection platforms can assist teaching secretaries in collecting teaching plans, syllabi, lesson plans, etc., submitted by teachers and unifying their naming formats, improving problems such as chaotic naming formats and inconsistent file formats caused by traditional collection methods, and making it easier for teaching secretaries to directly incorporate them into cloud electronic archives, thereby optimizing the teaching management process. If teachers or students need to retrieve relevant archived materials, they only need to input vague keywords, and artificial intelligence retrieval technology can automatically find relevant archive resources through semantic understanding and context analysis, solving problems such as insufficient storage space on teachers' devices. For the course scheduling and implementation of teaching plans that teaching secretaries are responsible for, artificial intelligence systems can assist in checking accuracy, ensuring that documents submitted to the academic affairs office are error-free<sup>[13]</sup>; in terms of student employment, they can also understand the job matching rate of graduates based on real-time updated basic archives of graduates on the big data platform, thereby adjusting course settings to prevent disconnection from society<sup>[14]</sup>.

### **3.5. Intelligent evaluation and feedback**

The intelligent management and optimization of teaching archives in higher vocational colleges based on artificial intelligence have shown great application value in the daily work of teaching secretaries, especially playing an important role in intelligent evaluation and feedback. As a key link connecting the school's teaching management and evaluation departments, as well as teachers and students, teaching secretaries undertake multiple responsibilities such as conveying teaching tasks, providing information, and managing archives, and their work efficiency directly affects the quality of teachers' teaching. Artificial intelligence technology has improved the communication efficiency between teaching secretaries and teachers/students through functions such as intelligent question-answering systems and automated scoring feedback. For example, teaching secretaries can not only import superior notification templates for reference, quickly draft and polish documents, convert the main body of notifications while conveying superior spirits, and issue notifications within the college, but also realize cloud management of archives through tools such as sync disks and cloud notes, thereby better ensuring the timely transmission and sharing of information. In archive management, the system can automatically encrypt and back up archives to prevent information leakage and ensure the security and integrity of archives<sup>[15]</sup>.

## **4. Conclusion**

In today's era of rapid development of artificial intelligence technology, applying it to the intelligent management and optimization of teaching archives in higher vocational colleges is not only an inevitable trend in the modernization of educational management but also an important way to improve teaching quality and promote educational equity. This study adopts strategies such as intelligent collection, intelligent sorting, intelligent management, intelligent service and utilization, and intelligent evaluation and feedback to better solve the problems encountered by teaching secretaries in routine teaching archives management and promote the modernization of teaching management.

### **Disclosure statement**

The author declares no conflict of interest.

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# Changes in Elementary Mathematics Education in the Era of Artificial Intelligence: Current Situations, Challenges, and Coping Strategies for Teachers

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**Abstract:** Against the backdrop of the rapid development of artificial intelligence technology, primary school mathematics education is undergoing profound structural changes. Based on the technology empowerment logic of artificial intelligence in the educational field, this paper systematically analyzes the main changes in primary school mathematics education in three aspects: teaching resources, classroom models and evaluation systems: first, the transformation of teaching resources from traditional paper to intelligent and diversified; second, the evolution of classroom teaching from “teacher-centered” to “student-centered” personalized interactive mode; third, the expansion of the evaluation system from terminal result evaluation to process-based, data-based, and multi-dimensional evaluation. In response to the current difficulties faced by teachers in adapting to the integration of technical literacy, teaching concepts and practices, this article proposes coping strategies such as improving information technology capabilities, building a personalized teaching system, establishing a scientific and reasonable multi-evaluation mechanism, and strengthening the combination of theory and practice, emphasizing the important support of inter-school cooperation and educational ecological synergy for the sustainable advancement of reform. This article aims to provide theoretical support and practical inspiration for the transformation of primary school mathematics education in the context of the artificial intelligence era, and to help improve education quality and modernize basic education.

**Keywords:** Artificial intelligence; Primary school mathematics; Teaching reform; Personalized teaching

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## 1. Introduction

With the continuous advancement of global technology, artificial intelligence is profoundly reshaping the structures of various sectors in society. In recent years, the digitalization and intelligent transformation of education have become increasingly prominent, particularly in basic education<sup>[1]</sup>. Elementary mathematics, as



a crucial subject for cultivating students' logical thinking, spatial imagination, and problem-solving skills, is undergoing profound transformations in both teaching methods and content. Traditional teaching models have long relied on teacher-led board lectures and mechanical memorization by students, approaches that not only fail to stimulate learning interest but also fall short in meeting the individualized development needs of students at different levels <sup>[2]</sup>.

Against this backdrop, the integration of artificial intelligence has injected fresh vitality into elementary mathematics education. By leveraging big data, machine learning, and virtual reality technologies, teachers can gain a more precise understanding of each student's learning condition and design instructional plans aligned with cognitive development patterns <sup>[3]</sup>. At the same time, the widespread application of smart devices, online education platforms, and interactive software has built convenient communication bridges between teachers and students, transforming the classroom from a rigid, traditional environment into a dynamic, interactive, and open space <sup>[4]</sup>. Additionally, AI plays an increasingly significant role in teaching evaluation, resource integration, and extracurricular tutoring, facilitating the comprehensive optimization and innovation of elementary mathematics education.

However, the rapid development of technology also poses challenges to the traditional education system and teachers' pedagogical methods. Teachers not only need to adapt to operating new technologies but must also shift their teaching philosophies. How to ensure the quality of knowledge transmission while simultaneously igniting students' learning interest and creative thinking has become an urgent problem requiring resolution <sup>[5]</sup>. Moreover, data-driven assessment methods and interactive classroom models introduced by intelligent technologies demand corresponding adjustments and investments in hardware, teacher training, and school management in order to truly achieve educational modernization.

## **2. Major changes in teaching**

### **2.1. Digitalization and intelligent transformation of teaching resources**

Artificial intelligence has driven a shift from traditional paper-based teaching materials to diversified, intelligent digital resources <sup>[6]</sup>. Powered by big data and cloud computing, personalized learning platforms can track students' learning trajectories, cognitive levels, and interests, recommending exercises, instructional videos, and interactive content tailored to their needs. This "teaching according to aptitude" approach not only addresses the shortcomings of traditional uniform teaching methods but also provides strong support for students' autonomous learning. In addition, the application of virtual reality (VR) and augmented reality (AR) technologies enables the visualization of abstract and difficult mathematical concepts. Through immersive experiences, students can grasp spatial structures and geometric relationships, significantly enhancing their understanding and memory of mathematical knowledge.

Moreover, the emergence of various online education platforms and micro-course videos has allowed teaching resources to transcend time and space barriers. Teachers can access the latest instructional cases and experimental data via online platforms, continuously updating and enriching their teaching content. The integration of information technology and artificial intelligence has created a vast, dynamic resource repository that not only meets the needs of basic knowledge instruction but also provides ample material for extracurricular exploration and interest development. As a result, the intelligent construction of teaching resources has become a key driving force behind current reforms in elementary mathematics education.



## **2.2. Transformation and upgrading of classroom models**

The application of AI has led to a fundamental transformation in classroom instructional models. The traditional “lecture-note-taking-exercise” approach is gradually being replaced by interactive, cooperative, student-centered classroom models <sup>[7]</sup>. Smart devices and real-time data monitoring allow teachers to track students’ learning conditions in real time, detect individual differences, and adjust teaching content and pace accordingly. In-class use of voting systems, real-time quizzes, and instant feedback enables teachers to promptly understand student comprehension levels and guide class-wide discussions through targeted questioning, fostering deeper engagement.

Furthermore, flipped classrooms and project-based learning are becoming increasingly popular in elementary mathematics teaching. In a flipped classroom, students study fundamental knowledge through online platforms before class, while classroom time is dedicated to solving complex problems, group discussions, and project-based activities. This approach not only enhances classroom efficiency but also cultivates students’ independent learning ability and collaborative spirit. Project-based learning, by placing students in real-world problem scenarios, guides them to apply mathematical knowledge practically, fostering integrated and innovative thinking. These new teaching models effectively break the temporal and spatial limitations of traditional education, making mathematics classes more dynamic, flexible, and engaging.

## **2.3. Diversification and process orientation of assessment systems**

Traditional assessment systems have primarily relied on final exam scores and assignment grades, making it difficult to comprehensively reflect students’ learning processes and overall capabilities. Today, driven by artificial intelligence, evaluation methods are evolving toward multi-dimensional, process-oriented, and dynamic systems. Using data collected from smart platforms, teachers can comprehensively assess students’ classroom participation, interactive performance, homework completion, online discussions, and group cooperation. Data-driven assessments allow teachers to identify students’ weaknesses in knowledge acquisition, logical thinking, and creativity promptly while providing scientific and quantifiable instructional feedback.

Additionally, dynamic evaluation systems incorporate self-assessment and peer-assessment components, encouraging students to engage actively in the evaluation process and cultivate self-reflection and self-improvement skills <sup>[8]</sup>. Personalized feedback reports help students clearly recognize their progress and shortcomings, enabling targeted adjustments in learning strategies. Such process-oriented assessment transforms evaluation from a mere terminal examination into a continuous driver of student learning motivation and growth. Overall, diversified assessment systems have injected new energy into elementary mathematics teaching, promoting comprehensive reforms in instructional methods and learning models.

In summary, elementary mathematics teaching in the era of artificial intelligence is undergoing profound changes in resource integration, classroom organization, and assessment methodologies. These transformations provide immense opportunities for educational innovation while presenting new challenges and expectations for traditional teaching models and the professional competencies of teachers. With ongoing technological advancements and deeper applications, this transformative trend is expected to accelerate, steering elementary mathematics education toward a future of greater intelligence, personalization, and efficiency.

## **3. Coping strategies for teachers**

### **3.1. Enhancing proficiency in information technology and intelligent applications**

In the face of rapid advancements in AI technology, teachers must proactively enhance their technological

literacy, mastering the principles and applications of big data, cloud computing, machine learning, and virtual reality in educational contexts <sup>[9]</sup>. Teachers can achieve this by participating in professional development programs, online courses, and academic seminars to continuously update their knowledge structures and improve their sensitivity to technological innovation. Only with a high level of digital literacy can teachers effectively incorporate smart tools into lesson design, optimize resource integration, and formulate targeted, differentiated instructional plans based on students' individual needs.

Educational institutions and administrative bodies should also establish robust training systems and practical platforms, offering teachers opportunities for hands-on engagement with new technologies. Through internal workshops, external collaborations, and expert consultations, teachers can share successful practices and collectively address challenges encountered in applying intelligent technologies in mathematics teaching. Furthermore, participation in educational technology research projects allows teachers to combine theory with practice, accumulating real-world cases and empirical data to support future reforms.

### **3.2. Building a student-centered personalized teaching system**

In the context of continuous technological development, the traditional teacher-centered model no longer meets students' increasingly diverse and individualized learning needs <sup>[10]</sup>. Teachers should make full use of intelligent platforms and big data analysis to monitor each student's learning progress, interests, and cognitive levels in real time, thereby developing differentiated teaching plans tailored to individual characteristics. By implementing stratified teaching, group collaboration, and individualized tutoring, teachers can ensure that each student receives adequate attention and develops at their own pace.

Furthermore, teachers should encourage students to utilize online resources, mathematical games, and virtual laboratories to foster autonomous exploration and inquiry-based learning. The application of the flipped classroom model serves as a key approach to achieving personalized teaching. By engaging in pre-class online learning, students can acquire basic knowledge in advance, allowing classroom time to focus on discussion, application, and problem-solving, thus promoting the internalization of knowledge and the simultaneous development of practical skills.

In addition, teachers should guide students in self-assessment and peer assessment, helping them cultivate reflection and self-regulation skills. Personalized feedback and regular progress tracking reports allow students to identify their strengths and weaknesses, enabling targeted improvements in learning strategies <sup>[11]</sup>. A data-driven, student-centered teaching system not only increases classroom efficiency but also stimulates students' intrinsic motivation, creativity, and innovative thinking, fostering well-rounded development in both academic and personal competencies.

### **3.3. Establishing a scientific and comprehensive multi-dimensional evaluation system**

The reform of evaluation systems is a cornerstone in achieving educational transformation <sup>[12]</sup>. Teachers must move beyond single-score assessments based solely on final exams and instead build multi-dimensional, dynamic, and process-oriented evaluation mechanisms with the support of AI technologies. Through smart platforms, teachers can collect and analyze data from various learning behaviors, including classroom participation, homework performance, online interactions, and group collaboration, offering a more holistic assessment of students' knowledge mastery, logical thinking, practical ability, and cooperative skills.

Moreover, integrating formative assessment, process evaluation, and summative assessment enhances students' intrinsic learning motivation <sup>[13]</sup>. Continuous feedback, personalized learning reports, and peer

assessments allow students to track their growth trajectories, adjust learning strategies in a timely manner, and foster a sense of achievement. In designing evaluation criteria, teachers should consider not only academic knowledge but also skills, emotional development, and values, thereby creating a system that encourages holistic student development.

### **3.4. Strengthening the integration of theory and practice and promoting inter-school and multi-stakeholder collaboration**

In the face of new technological challenges, teachers should emphasize the integration of theoretical learning and practical exploration. Teachers are encouraged to document their experiences in applying intelligent technologies in mathematics classrooms through case studies and research papers, contributing to professional growth and pedagogical innovation. Schools should enhance horizontal collaboration by organizing demonstration lessons, academic seminars, and educational technology projects, creating cross-school and cross-regional exchange platforms to jointly discuss cutting-edge applications and emerging challenges in intelligent education <sup>[14]</sup>.

At the same time, teachers should actively engage with parents, community organizations, and research institutions to establish collaborative ecosystems. Home-school collaboration, school-enterprise partnerships, and community resource sharing can provide students with broader learning opportunities and real-world application experiences.

In conclusion, the era of artificial intelligence presents both unprecedented opportunities and formidable challenges for elementary mathematics education. Teachers must continuously update their teaching philosophies, enhance their professional competencies, and actively construct personalized, student-centered instructional frameworks supported by intelligent technologies. By establishing multi-dimensional, data-driven evaluation systems and fostering strong connections between theory and practice, teachers can harness the advantages of AI to promote profound instructional transformation <sup>[15]</sup>.

Furthermore, through active collaboration across schools, communities, and industries, a supportive educational ecosystem can be formed, facilitating the integration of cutting-edge technologies into classroom teaching. Ultimately, only by fully leveraging the potential of AI can elementary mathematics education achieve higher levels of teaching quality, educational equity, and personalized development. This endeavor not only addresses current pedagogical challenges but also lays a solid foundation for the modernization of basic education, paving the way for an intelligent, efficient, and innovative future in elementary mathematics teaching.

## **4. Conclusion**

Elementary mathematics education is currently at the forefront of digital and intelligent transformation. The integration of artificial intelligence has not only enriched teaching resources and diversified classroom models but also driven the reform of assessment systems. These changes collectively highlight a paradigm shift from teacher-centered to student-centered education, from uniform instruction to personalized learning, and from terminal evaluation to process-oriented assessment. Such transformations provide unprecedented opportunities for improving teaching quality, stimulating students' curiosity, and cultivating their logical reasoning and problem-solving abilities.

Nevertheless, the transition toward intelligent education also raises critical challenges. Teachers are required to adapt rapidly to technological innovations, reconstruct their pedagogical philosophies, and maintain a delicate balance between knowledge transmission and competence cultivation. At the same time, ensuring educational

equity, preventing excessive dependence on technology, and addressing infrastructure gaps remain pressing concerns.

To fully harness the potential of AI, it is essential to strengthen teachers' digital literacy, build personalized instructional systems, and construct multi-dimensional evaluation frameworks supported by intelligent technologies. Equally important is fostering collaboration across schools, families, and communities, thereby creating an inclusive and sustainable educational ecosystem. Looking forward, the modernization of elementary mathematics education will depend not only on the advancement of technology itself but also on the integration of humanistic values, professional expertise, and institutional support.

In short, artificial intelligence should be regarded as both a tool and a catalyst for educational reform. When combined with thoughtful pedagogy and collaborative governance, it has the potential to significantly elevate the quality and equity of elementary mathematics education, laying a solid foundation for the cultivation of innovative talents in the era of intelligence.

## Disclosure statement

The author declares no conflict of interest.

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# Application of AI-Enabled Teaching in the Course of Probability Theory and Mathematical Statistics

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**Abstract:** To address the shortcomings of traditional teaching methods in personalized support, real-time feedback, and comprehensive evaluation, this study proposes an AI-driven instructional model. The model provides students with personalized learning paths and structured resources through intelligent recommendation systems and knowledge graphs; optimizes the learning process by integrating blended learning to achieve a closed-loop system encompassing self-directed pre-class preparation, interactive in-class engagement, and targeted post-class reinforcement; and establishes a multidimensional evaluation system that combines formative assessment with competency-based evaluations of competition performance and practical skills, thereby fostering students' comprehensive development. The findings demonstrate that this model not only significantly enhances students' mastery of theoretically challenging courses such as Probability and Mathematical Statistics, but also improves learning initiative and practical application skills, offering a scalable intelligent solution for the reform of mathematics education in higher education institutions.

**Keywords:** AI-enabled teaching; Blended learning; Knowledge graph

**Online publication:** September 26, 2025

## 1. Introduction

With the advancement of educational informatization, the application of AI technology in teaching has become increasingly widespread<sup>[1-5]</sup>. Traditional teaching methods are unable to meet the personalized needs of every student, whereas AI, through intelligent recommendation systems and personalized learning path designs, can recommend suitable learning resources based on students' learning behaviors and progress in real time. AI also provides immediate feedback and suggestions, helping students grasp knowledge more efficiently. At the same time, AI-assisted teaching can optimize the teaching process, enhance teaching interactivity and classroom efficiency, and establish a diversified evaluation system, thereby comprehensively promoting the development of students' overall qualities. Probability theory and mathematical statistics are mathematical disciplines that study the objective laws of random phenomena and apply them in practice. They are fundamental courses in mathematics with a wide audience and high attention. In traditional teaching of probability theory and

mathematical statistics, due to the abstract nature of the subject and the complexity of its knowledge structure, students often struggle to internalize fundamental concepts such as probability distributions, expectations, and variances. The knowledge system is extensive and highly interconnected, and students often lack a clear understanding and intuitive recognition, which leads to confusion and frustration, making it difficult to establish a complete knowledge framework. Traditional teaching lacks personalized support, and students with different learning levels cannot receive targeted guidance. As a result, high-performing students may find the content too simple, while weaker students may struggle to keep up, which affects their practical application abilities.

## **2. AI-enabled teaching resource integration for promoting efficient learning**

The use of AI to construct knowledge graphs to support teaching is becoming an important trend in the field of education, especially in knowledge management and personalized learning. For example, Qin et al. (2024) studied the method of constructing a knowledge graph using AI, taking database courses as an example <sup>[6]</sup>. Bai et al. (2024) studied the design and application of knowledge graphs in AI teaching platforms, focusing on semantic analysis-based teaching resource retrieval, and demonstrated its effectiveness through an experiment showing improved student scores <sup>[7]</sup>. A knowledge graph visualizes the relationships and hierarchical structure between different knowledge points through nodes and edges, helping students understand complex subject matter <sup>[8–10]</sup>. When constructing a knowledge graph, AI technologies such as Natural Language Processing (NLP), machine learning, and deep learning are used to automatically analyze vast amounts of teaching resources, textbooks, academic papers, and student feedback, thereby extracting connections between knowledge points and concepts to form a systematic knowledge network.

In teaching activities, specifically for the course “Probability Theory and Mathematical Statistics,” AI can systematize and visualize scattered course content through the construction of a knowledge graph, thus improving learning efficiency. The knowledge graph uses core concepts from courses like probability theory and mathematical statistics (such as random events, distributions, expectations, etc.) as nodes, and dynamically links resources such as videos, question banks, and case analyses to corresponding knowledge points, forming a clear and structured network. Teachers can embed preset learning objectives into the graph, allowing students to quickly locate key content and understand the intrinsic relationships between knowledge points. At the same time, AI algorithms can analyze student learning behaviors and data to dynamically adjust the content of the graph, for example, recommending supplementary materials or extended learning paths based on the student’s mastery level, thereby avoiding wasted learning resources.

On the other hand, the knowledge graph, combined with intelligent search functions, can help students quickly locate the resources they need through keyword searches, improving problem-solving efficiency. Through this resource integration, AI not only provides students with a panoramic learning framework but also offers teachers valuable teaching data feedback, optimizing teaching strategies and achieving efficient management and precise allocation of learning resources.

## **3. AI empowered blended learning model: Optimizing the learning process**

Blended learning <sup>[11–16]</sup> is a model that combines traditional face-to-face teaching with online learning, consisting of three stages: pre-class flipped learning, in-class deepening learning, and post-class consolidation. Pre-class, teachers upload resources such as textbooks and videos on platforms like Chaoxing Learning Platform,

allowing students to learn independently and complete tasks. Teachers use statistical data to assess students' learning progress and plan teaching activities. In-class, teachers explain key points based on students' pre-class preparation, answer questions, organize interactive discussions, and design online assignments or projects. Through data analysis, teachers evaluate students' abilities and optimize teaching strategies. Post-class, teachers collect student feedback to improve teaching plans. This blended online-offline model provides the foundation for AI-assisted teaching, enabling precise support for each teaching phase and enhancing learning outcomes.

### **3.1. Pre-class flipped learning**

Teachers upload teaching materials to the Chaoxing Learning Platform, and with the help of an AI recommendation system, personalized supplementary resources (such as short videos, case articles, and interactive exercises) are pushed to students based on their learning progress and behavioral data, helping them consolidate knowledge more efficiently. At the same time, teachers can use AI to generate targeted pre-study quizzes with automatic grading functionality, accurately recording students' common errors and weak areas. Additionally, teachers can post thought-provoking questions in the platform's discussion area, such as "How can the total probability formula be used to predict user preferences?" to guide students in interactive pre-study. With AI's real-time feedback functionality, teachers can comprehensively assess students' pre-class preparation, enabling them to adjust the classroom content precisely to ensure the teaching objectives align closely with students' needs. Through the collaborative support of the Chaoxing Learning Platform and AI technology, teachers can not only implement an efficient flipped classroom pre-study model but also help students master core concepts solidly, laying a strong foundation for subsequent classroom discussions and case analyses.

### **3.2. In-class deepening learning**

Taking conditional probability and the total probability formula as examples, in the in-class deepening phase, teachers can set practical real-life scenarios (such as "recommending the most interesting movie categories based on a user's viewing history") to help students intuitively understand the specific application of conditional probability and the total probability formula in recommendation systems. With AI-powered intelligent grouping, teachers can form complementary learning groups based on students' pre-class preparation performance, allowing each group to collaborate on a preference prediction task. During the presentation stage, students can use the AI Q&A function on the Chaoxing Learning Platform to raise questions, and AI will provide immediate explanations or knowledge supplements, helping students correct misconceptions and deepen their understanding of the formulas. Subsequently, teachers can use the AI recommendation system simulator to dynamically demonstrate the personalized recommendation logic based on conditional probability and total probability calculations, allowing students to visually experience the recommendation system's operation. At the end of the class, the AI data analysis function generates a detailed learning report, covering students' participation, quiz scores, and discussion records, helping students clearly identify their weak points while also providing teachers with valuable support in summarizing the course content and clarifying the application logic of conditional probability and the total probability formula in recommendation systems.

### **3.3. Post-class consolidation learning**

In the post-class phase, AI recommends suitable learning resources based on students' classroom performance, helping weaker students fill in gaps and providing advanced resources for high-performing students. In the discussion area, AI answers common questions, while teachers focus on addressing difficult points, reinforcing

students' understanding of the knowledge. Additionally, AI-generated personalized mistake analysis and class error reports effectively assist in targeted revision, helping students overcome learning bottlenecks. Furthermore, the post-class comprehensive learning report allows both teachers and students to fully understand the learning progress, providing a scientific basis for personalized guidance, ensuring that every student can comprehensively master the practical application of conditional probability and the total probability formula. Through this full-process teaching design, the deep integration of the Chaoxing Learning Platform and AI technology has truly realized a closed-loop learning model that spans pre-class flipped learning, in-class deepening, and post-class consolidation, greatly enhancing teaching efficiency and learning outcomes.

#### **4. AI Empowered multi-dimensional and process-oriented teaching evaluation system and assessment methods to enhance teaching effectiveness**

In modern education, constructing a scientific and comprehensive teaching evaluation system is crucial. The introduction of AI technology provides strong support for achieving this goal. Through data analysis and intelligent evaluation, AI not only focuses on learning outcomes but also delves into the details of the learning process, enabling precise evaluation and personalized guidance.

##### **4.1. AI-assisted teaching evaluation system**

- (1) Personalized Evaluation Mechanism. AI technology analyzes students' online learning behaviors, assignment completion, classroom interactions, and other data to provide teachers with personalized feedback. This helps adjust learning paths to maximize learning outcomes. AI systems can also offer instant feedback and suggestions, helping students identify and address knowledge gaps.
- (2) Combination of Process-Oriented and Outcome-Oriented Evaluation. AI helps teachers track students' learning progress in real-time and conduct process-oriented evaluations, allowing for the timely identification and resolution of learning difficulties. This avoids relying solely on final exams for evaluation, ensuring that the assessment is comprehensive and accurate.

##### **4.2. AI-assisted multi-dimensional assessment**

- (1) By dynamically tracking students' learning processes, AI can assess learning attitudes, participation, and practical abilities in real time, helping teachers adjust their teaching strategies.
- (2) AI Integration with "Learning through Competitions." AI can recommend competitions such as mathematical modeling and statistical modeling contests, tracking students' innovation, problem-solving skills, and teamwork performance, which can then be incorporated into the assessment system.
- (3) AI Integration with School-Enterprise Collaboration. Schools and enterprises can collaborate through AI platforms to customize courses and practical projects. When students participate in enterprise projects, AI evaluates their task completion, innovation, teamwork, and other performances in real time, incorporating these data into the evaluation system to ensure a comprehensive assessment of students' abilities.

#### **5. Conclusion**

This paper explores the use of AI technology in teaching probability theory and mathematical statistics to



optimize the teaching process and enhance learning outcomes. It discusses how AI, through knowledge graphs and recommendation systems, can structure and visualize course content, helping students better understand key concepts and personalize their learning resources. AI supports blended learning, especially in flipped classrooms, by enabling pre-class self-learning and real-time tracking and feedback on students' progress. In-class, AI enhances student interaction and allows teachers to provide targeted support based on real-time data. Finally, the paper explores a diversified AI-assisted evaluation system that tracks learning progress and assesses students' creativity, teamwork, and practical skills, promoting innovation through project-based learning and competitions.

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# New Era of Smart Classrooms-Innovation and Autonomous Learning Enhancement in Linear Algebra Courses Driven by Artificial Intelligence

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**Abstract:** Artificial Intelligence (AI) offers innovative solutions to address the teaching challenges of linear algebra courses caused by their high level of abstraction, such as students' difficulties in comprehension, lack of interest, and weak self-directed learning abilities. This study proposes empowering educators to reconstruct teaching models through three key strategies: building intelligent teaching platforms (enabling personalized resource recommendations, learning path planning, and real-time feedback), leveraging data-driven instructional decisions (to dynamically optimize teaching content), and deploying intelligent tutoring systems (with virtual assistants to explain abstract concepts). Meanwhile, to tackle challenges such as data privacy, teachers' adaptability to technology, and integration of educational resources, it is necessary to enhance data security mechanisms, strengthen teacher training, and promote inter-institutional collaboration. Future development will move toward multimodal interaction (e.g., VR/AR to enhance visual intuition) and interdisciplinary integration, advancing AI from a supporting tool to a core driving force of educational innovation, ultimately serving the goal of cultivating high-quality, versatile talents.

**Keywords:** Artificial intelligence; Self-directed learning; Linear algebra; Teaching reform

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## 1. Introduction

With the rapid advancement of information technology, Artificial Intelligence (AI), as the core driving force of a new round of technological revolution and industrial transformation, is permeating all sectors of society and the economy with unprecedented depth and breadth, and the field of education is no exception<sup>[1-4]</sup>. As the main front for cultivating high-level talents, higher education now faces an urgent need and a cutting-edge research focus: how to effectively leverage AI to drive deep reforms in curriculum systems, teaching models, and evaluation methods, thereby improving the quality and efficiency of instruction<sup>[5]</sup>.

Linear algebra, a fundamental theoretical course essential to disciplines such as mathematics, computer science, physics, engineering, and economics, is characterized by highly abstract and logically rigorous core

concepts, including matrices, vector spaces, linear transformations, eigenvalues, and eigenvectors <sup>[6,7]</sup>. These features commonly lead to student difficulties in comprehension, weak intuitive connections, and low learning motivation. The traditional one-way “teacher lectures, students listen” model often fails to address these challenges effectively, resulting in suboptimal learning outcomes. Consequently, exploring how to harness the power of AI to reshape the teaching process, stimulate intrinsic student motivation, and cultivate higher-order thinking skills and independent inquiry habits has become a critical problem urgently needing resolution by university educators, particularly those teaching foundational courses.

This paper focuses on the linear algebra course and aims to systematically explore feasible pathways, practical models, potential challenges, and corresponding strategies for AI-empowered curriculum reform and innovation in higher education. By combining theoretical analysis with practical case studies, it seeks to provide front-line university teachers with actionable ideas and methods to promote deep integration of AI with teaching and learning, ultimately serving the goal of cultivating high-quality, innovative talents.

## **2. Current status and existing problems in linear algebra course teaching**

### **2.1. Strong abstraction of course content**

The core appeal of linear algebra lies in its abstraction and universality, but these very qualities also present the main challenges in teaching. Concepts such as “n-dimensional vector space,” “linear independence,” and “rank” rely heavily on mathematical notation and formal definitions, with relatively weak intuitive connections to the real world. Students often find themselves lost in a maze of symbolic manipulation, struggling to grasp the geometric interpretations and physical meanings behind these ideas <sup>[8]</sup>. This high level of abstraction significantly increases cognitive load, particularly when tackling complex problems, such as solving large systems of linear equations or understanding the applications of singular value decomposition, leading to frustration and anxiety, which in turn hinders the deep understanding and internalization of key concepts.

### **2.2. Limitations of traditional teaching models**

Currently, linear algebra courses still primarily adopt a traditional teacher-centered instructional model, where classroom teaching is dominated by lectures and students passively receive knowledge. This one-way transmission lacks sufficient interactive elements and real-time feedback mechanisms, making it difficult to stimulate students’ interest in learning. As a result, the classroom atmosphere becomes monotonous, and student engagement remains low. In such a learning environment, students have limited opportunities for in-depth thinking and discussion, leading to a lack of knowledge internalization and difficulty in truly understanding and mastering course content.

At the same time, constrained by the limitations of traditional teaching methods, students often lack systematic learning strategies and effective tools for self-directed learning. They struggle to personalize their study plans according to their cognitive characteristics and learning pace. When they fail to grasp the content during class, they find it difficult to make up for the gap on their own, which leads to the accumulation of knowledge deficiencies. The lack of autonomous learning ability not only affects their current academic performance but also hinders their progress in subsequent courses, limiting the development of their innovative thinking and ability to apply knowledge in an integrated manner.

Therefore, it is imperative to introduce modern educational technologies such as artificial intelligence to transform traditional teaching models. This will help build a learning environment that is highly interactive,

provides timely feedback, and promotes learner autonomy, thereby enhancing students' proactive learning awareness and capabilities, and ultimately improving the overall teaching quality of linear algebra courses <sup>[9,10]</sup>.

### **3. Theoretical foundation of AI empowerment in teacher-led course development**

#### **3.1. Theoretical exploration of AI and education integration**

In recent years, the application of artificial intelligence technology in the education sector has gradually matured. Based on technologies such as big data, machine learning, and natural language processing, AI can enable intelligent recommendation of teaching resources, personalized learning path planning, and real-time monitoring of online learning processes. The theory of educational informatization posits that by breaking the time and space constraints of traditional teaching through technological means, personalized instruction ("teaching according to students' aptitude") can be achieved, thereby meeting the individual needs of different students and improving teaching quality and efficiency <sup>[11]</sup>.

#### **3.2. Application of autonomous learning theory in teaching**

Autonomous learning theory emphasizes that students should actively construct their knowledge systems, continuously improving their learning abilities through self-exploration and practice <sup>[12]</sup>. AI systems can provide students with personalized learning plans, monitor learning progress in real time, and provide feedback, which helps to stimulate students' enthusiasm for learning and cultivate their autonomous learning abilities <sup>[13-15]</sup>.

### **4. Practical application of artificial intelligence in curriculum development reform**

#### **4.1. Construction of intelligent teaching platforms**

Using artificial intelligence technology to build intelligent teaching platforms is an important means of achieving curriculum development reform. Taking Linear Algebra as an example, the platform can integrate the following functions:

- (1) Intelligent Recommendation of Learning Resources: Based on students' learning records and knowledge mastery, the platform can recommend targeted resources such as textbooks, videos, exercises, etc., to help students form a knowledge framework.
- (2) Personalized Learning Path Planning: Through data analysis, the system can create personalized learning plans for students with different learning progress, ensuring that each student can gradually deepen their understanding of knowledge points at their own pace.
- (3) Real-time Learning Monitoring and Feedback: Using machine learning algorithms, the platform can monitor students' learning progress in real time and provide feedback through online tests and practice exercises, helping teachers understand students' grasp of the material and offer targeted guidance.

#### **4.2. Data-driven teaching decisions**

Artificial intelligence technology can not only provide personalized learning support for students but also offer data support for teachers. Teachers can use data analysis tools to understand students' grasp of different knowledge points, common mistakes, and learning trends, allowing them to adjust teaching strategies and optimize classroom design. For example, if data analysis shows that most students struggle with matrix operations in Linear Algebra, teachers can add targeted explanations and exercises in subsequent lessons.

### **4.3. Intelligent tutoring systems and virtual teaching assistants**

Intelligent tutoring systems and virtual teaching assistants are key components of AI applications in curriculum development. These systems can use natural language processing technology to answer students' questions during the learning process, while virtual teaching assistants can simulate the teacher's role, providing online Q&A and guidance. For complex concepts in Linear Algebra, virtual teaching assistants can provide detailed step-by-step explanations and example demonstrations, making abstract concepts more tangible and helping students better understand and apply the knowledge.

## **5. Challenges and countermeasures in AI empowered teaching reform**

### **5.1. Data privacy and security issues**

In the process of applying artificial intelligence for teaching reform, the collection and analysis of large amounts of data inevitably raise concerns about student privacy and data security. To address this, schools and platforms must strictly adhere to relevant laws and regulations, establish robust data encryption and access control mechanisms, and ensure the security and confidentiality of data during use.

### **5.2. Technological adaptability and teacher capacity building**

Although AI technology provides strong support for teaching reform, some teachers have limitations in applying technology effectively. To address this, universities should organize regular training and seminars to enhance teachers' technical skills, enabling them to fully utilize AI tools for teaching design and classroom management. Additionally, a collaborative mechanism between teachers and technical experts should be established to jointly solve the practical problems encountered in the application.

### **5.3. System improvement and resource integration**

Building intelligent teaching platforms requires a wealth of high-quality educational resources, yet some schools still face challenges in integrating teaching resources and constructing platforms. There should be increased cooperation between universities, departments, and industry to jointly develop and share quality educational resources, promoting continuous improvement and upgrading of platform functions. Moreover, for foundational courses like Linear Algebra, it is important to develop practical cases and experimental projects that align with industry needs, enhancing the practical value of the course.

## **6. Future outlook**

The AI-driven reform and innovation in teacher-led course development is a continuously evolving process. In the future, as technology advances and teaching concepts evolve, intelligent teaching platforms will become more refined and widespread. For foundational courses such as Linear Algebra, the future development trends include the following aspects: First, deep integration and personalized learning. Future intelligent teaching platforms will focus more on personalized learning experiences, using more precise data analysis and intelligent algorithms to provide customized learning plans for students, further enhancing their autonomous learning abilities. Second, multimodal interaction and virtual reality. With the development of technologies such as virtual reality (VR) and augmented reality (AR), AI-based multimodal interactive teaching models will gradually be realized, offering more intuitive and engaging teaching displays for abstract courses like Linear Algebra. Finally, interdisciplinary



collaboration and innovative applications. Future teaching reforms will break down disciplinary barriers and promote interdisciplinary collaborative innovation. Mathematical theories based on Linear Algebra will deeply integrate with fields such as computer science and engineering technology, cultivating interdisciplinary talents with cross-boundary thinking and practical abilities.

## 7. Conclusion

In the current era of global digital transformation, Artificial Intelligence (AI) has become a pivotal force reshaping the landscape of higher education. For university educators, AI is far more than just an auxiliary teaching tool; it is the golden key to unlocking educational innovation. It empowers curriculum development in an all-encompassing and profound manner, triggering transformative changes in teaching models, propelling education from tradition to modernity, from uniformity to diversity, and from isolation to openness. AI continuously injects powerful momentum into the high-quality development of higher education.

In the challenging yet opportunity-filled domain of linear algebra education, the introduction of AI is like a timely rainfall. With intelligent teaching platforms as its foundation, AI delivers personalized learning resources to students, akin to lighting beacons that guide learners through the maze of knowledge. Personalized learning path planning crafts tailor-made journeys for each student, allowing them to progress steadily at their own pace without being constrained by standardized teaching schedules—thus realizing the ideal of differentiated instruction. Real-time learning monitoring and feedback systems act as the teacher's eyes and ears, continuously tracking students' learning status, promptly identifying issues, and offering targeted guidance, making teaching more focused and effective.

Data-driven instructional decisions give educators a powerful lens to observe students' learning conditions. By mining vast amounts of data, teachers can discern students' mastery of specific concepts, uncover areas of confusion, and identify learning trends. This enables precise adjustment of teaching strategies, allowing content to be delivered like timely rain to the driest areas of students' knowledge structures—significantly enhancing the scientific grounding and effectiveness of instruction. Meanwhile, intelligent tutoring systems and virtual teaching assistants serve as ever-present companions to students, ready to answer questions and simplify abstract, complex concepts through vivid examples and detailed explanations. With such support, learning becomes a guided journey of exploration, no longer a solitary and daunting struggle.

However, the path of AI-empowered educational reform is not without its hurdles. Data privacy and security issues loom like the sword of Damocles, where a single misstep can lead to serious consequences. Schools and platforms must remain vigilant at all times, safeguarding student data with the strictest standards and most rigorous measures to ensure that technology usage always stays within the bounds of legality and compliance. Teachers, as the implementers of educational reform, also face adaptation challenges when it comes to new technologies. Institutions should actively build broad platforms for training and communication, helping educators continuously improve their technical competencies so they can confidently and effectively use AI tools in instructional design and classroom management, turning technology into a powerful teaching asset rather than a burden.

At the same time, the construction and development of intelligent teaching platforms face challenges related to resource integration and system optimization. Schools should expand collaboration channels, strengthen cooperation across institutions, departments, and even with enterprises, bringing together high-quality educational resources from multiple sources. This will enrich the platform's content, refine its functional design,

and transform it into an ever-evolving treasure trove of education, providing teachers and students with abundant, efficient, and convenient support.

In summary, the journey of AI-empowered curriculum reform and innovation in higher education is well underway. It offers educators unprecedented opportunities to break free from traditional teaching limitations and achieve a transformative leap in instructional models. Looking ahead, as technology continues to advance and educational philosophies evolve, AI is poised to write even more brilliant chapters in the realm of higher education—cultivating generations of high-quality talents with innovative minds and practical abilities, and propelling society toward a more prosperous and promising future.

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# Exploration and Practice of the Training Model for Curriculum in Engineering Education: A Case Study of Emergency Communication

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**Abstract:** In the field of emergency communication teaching, traditional approaches are increasingly struggling to keep pace with the rapid development of modern industries. These conventional models focus primarily on one-way transmission of theoretical knowledge, leading to a disconnect from real-world application scenarios. Consequently, students lack practical proficiency and fail to meet the industry's talent requirements. Through a thorough analysis of the shortcomings in existing curriculum plans, this paper innovatively proposes a teaching model based on OBE-CDIO and actively applies it to the teaching practice of emergency communication technology. During implementation, teaching content is systematically broken down into multiple interrelated sub-projects to form a complete project chain. For each project, the four key phases of the CDIO framework are strictly adhered to: Conceive (to inspire creativity), Design (to formulate plans), Implement (to put ideas into action), and Operate (to test outcomes). Simultaneously, assessment methods have been reformed: open-ended questions are used to evaluate students' thinking abilities, while project-based assessments measure their practical achievements. This enables a comprehensive and accurate evaluation of teaching effectiveness. Finally, student feedback was collected via questionnaires to conduct an in-depth analysis of the application of this emergency communication curriculum training model in engineering education. The results indicate that this model has yielded significant results in boosting students' learning interest and practical abilities, while also significantly enhancing the quality of emergency communication teaching.

**Keywords:** OBE; CDIO; Emergency communications; Course teaching mode

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## 1. Introduction

Emergency communication is an important part of the emergency response mechanism, drawing increasing attention not only from the communications sector but also from governmental authorities. Emergency communication systems in city operations during sudden disasters or accidents bear the function of timely, accurate, and smooth transmission of first-hand information, as the decision-makers correctly direct the rescue

and relief of the central nerve <sup>[1]</sup>. At present, the country the provinces, and cities are in urgent need of talent in this area, and the construction of an emergency communication teaching system provides a basic guarantee for talent cultivation.

ITU-T began to pay attention to emergency communication in 2001, mainly from the provision of international emergency calls and network support for emergency communication needs to enhance the capacity and other aspects of research, involving the emergency communication service ETS (Emergency Telecommunications Service) and disaster reduction communication service TDR (Telecommunication for Disaster Relief). ITU-R, as an international standard organization, mainly conducts research on emergency communication from the perspective of early warning and disaster mitigation, including the use of fixed satellites, radio broadcasting, mobile, wireless positioning, etc., to provide the public with emergency services, early warning information, and disaster mitigation <sup>[2]</sup>.

The Outline of the National Plan for Medium- and Long-term Educational Reform and Development (2010–2020) highlights quality improvement as the core task of higher education development. The supply-side structural reform of higher education is to improve the quality of talent training on the supply side, oriented to social demand so that graduates can meet the needs of society and their development, and so that China can move from a large country of higher education to a strong one at an early date <sup>[3]</sup>.

Over the past two decades, numerous countries have been actively promoting the reform of engineering education, exploring the cultivation mode of innovative engineering and scientific talents, optimizing the engineering education mode and teaching methods, and improving the comprehensive ability of graduates. The CDIO initiative, a modern outcome of global engineering education reforms, focuses on equipping students with essential engineering and technical knowledge, personal and team skills, and system abilities necessary for thriving in modern engineering environments. And advocates the educational concept of ‘learning by doing’. It advocates the educational concept of ‘learning by doing’ and guides students to learn engineering content in an active, practical, and organically linked way between courses <sup>[4–6]</sup>.

The teaching objective of the emergency communication course is to enable students, through learning, to master emergency communication-related technologies, and to be able to choose efficient communication technologies to deal with and respond to the occurrence of events in response to sudden and specific emergency events, and to play a role in mitigating emergencies. In this paper, we will combine the CDIO engineering education model with the OBE teaching concept as a guide to explore the teaching mode of the emergency communication course applicable to emergency management and communication engineering majors <sup>[7–10]</sup>.

## **2. Features and challenges in the emergency communication course teaching**

“Emergency Communications” is a professional limited course in the teaching of emergency management and communication engineering, and the teaching content is built based on “Emergency Management” as well as “Principles of Communication,” “Computer Communication,” and other basic compulsory courses, involving relevant knowledge of system science and information science. Starting from the goal of safety rescue, the course applies the basic principles and methods of communication engineering to provide emergency protection for public emergencies. Emergency communication is characterized by the suddenness of time, the uncertainty of location, the uncertainty of capacity demand, the diversity of information, and the complexity of the environment, which puts forward higher requirements on the transmission and exchange of information, and constitutes its industry characteristics. It seeks to find accident warnings from human-machine relationships and methods to



improve system reliability communication.

Due to the content of the emergency communication course involves architecture, emergency communication vehicles, satellite communication technology, individual emergency systems, digital trunking communication, short-wave communication, microwave communication, wireless positioning technology, and the development of new technologies, etc., the knowledge structure is more complex, the application requirements are higher, and at the same time, there are big differences in the mastery of students for the basics of wireless communication, which leads to a big difference in the teaching process of students' understanding of the knowledge points, and the effect of classroom teaching is difficult to achieve the intended goal <sup>[11-13]</sup>.

Teaching challenges in the emergency communications course are as follows:

- (1) Students have low attention spans in the classroom. Emergency communications courses are usually offered in the seventh semester when students are facing graduation and are at a stage where they need to think about their future development. Things such as postgraduate exams, job searches, and various civil service exams affect students' interest in learning their professional knowledge, and learning efficiency is generally low.
- (2) Classroom teaching methods are boring. The emergency communication system has many knowledge points, and each knowledge point is scattered and abstract, the traditional PPT lesson plan teaching, it easy to cause students to have a lower understanding of knowledge points in class, and cannot stimulate the students' interest in learning, after the class is even less interested in reviewing the contents of what has been learned.
- (3) A single method of assessment. Before the examination, students usually just combine the examination papers of recent years and adopt a rote learning way of preparing for the examination, without understanding the meaning of the knowledge points, which leads to students forgetting what they have learned after the examination.
- (4) The experimental operation is unclear. The traditional experiment is a kind of operation procedure arrangement; students follow the steps to experiment. Students do not have a full understanding of the relevant theoretical knowledge, and cannot analyse the causes of different experimental phenomena from those in the experimental guidebook, which fails the experimental class to foster problem analysis and problem-solving skills.

The above aspects have led to a year-on-year decline in the pass rate of the course and a gradual decrease in the number of students taking the course. How to improve the teaching quality of the course has become an urgent problem for the emergency communications program.

### **3. Existing teaching reform programs for professional courses**

With the rapid development of modern information technology, college students in higher education have a strong interest in and acceptance of new things, new technologies, and new forms of application. The richness of network resources and the widespread popularity of streaming media have provided more and wider new ideas for modern teaching. Aiming at the problems existing in the teaching of traditional professional courses, many education practitioners have researched and summarized the corresponding reform model, which can inhibit or improve the effect of one or several problems <sup>[14,15]</sup>.

The content of the emergency communications course covers a wide range of technologies and application areas, which requires students to have strong knowledge of the fundamentals of wireless communications and

the ability to quickly adapt to new technologies. Because of the teaching problems faced by the emergency communication course, the following improvements are suggested:

- (1) Increase student motivation: Since students are distracted as they are approaching graduation, they can improve their interest in learning by adjusting the course schedule and advancing courses with strong practicality. At the same time, the importance of emergency communication in students' future career development should be emphasized to stimulate their learning motivation. Meanwhile, different levels of teaching content are designed according to the student's basic knowledge level, for students with a weak foundation, remedial courses or tutorial session on the basics of wireless communication can be added.
- (2) Adoption of diversified teaching methods: To address the problem of boring traditional classroom teaching methods, case teaching, role-playing, simulation exercises, and other interactive teaching methods can be used to increase students' participation and interest. Encourage students to participate in classroom discussions, and stimulate students' interest and initiative in learning through questions and group discussions. For example, by simulating emergency communication scenarios, students can operate equipment in a simulated environment to enhance their practical ability.
- (3) Reform of appraisal methods: To address the problem of a single assessment method, diversified assessment methods, such as project reports, practical tests, and group discussions, can be adopted to comprehensively assess students' learning effectiveness. At the same time, students are encouraged to demonstrate an in-depth understanding of the knowledge points in the examination instead of just memorizing them. Through regular tests and assessments, students' learning progress is monitored and timely feedback is provided to help them adjust their learning strategies.
- (4) Enhancement of experimental teaching: For problems where the experimental operation is unknown, students can take the initiative to explore and solve problems in the experiment by designing more challenging experimental projects. Teachers should provide clear experimental instructions and guide students to understand the experimental principles and operation steps during the experiment. Online courses and virtual simulation experiments, such as 5G airwave propagation and wireless channel measurement experiments, are utilized to provide students with flexible learning methods.
- (5) Use of information technology: Promoting the development of 'education + Internet', establishing a system of digital educational resources covering all grades and subjects, accelerating the construction of digital campuses, and actively exploring Internet-based teaching. The latest emergency communication technologies, such as satellite communications and unmanned aerial vehicle emergency communications, have been integrated into the curriculum so that students are aware of the latest trends in technological development.
- (6) Strengthening the teaching staff: Improving teachers' educational and teaching skills, especially their practical teaching skills. Teachers' professionalism and teaching skills can be upgraded through teacher training and industry exchanges.
- (7) Optimizing course content: The course content is regularly updated according to the development trend of the industry and the needs of students to ensure that the teaching content is cutting-edge and practical. Students are encouraged to learn across disciplines and incorporate knowledge from other fields, such as geographic information systems (GIS) and data analysis, to enhance their understanding of the application of emergency communication technologies.
- (8) Enhancement of practical teaching equipment: Increase practical teaching equipment to improve the hands-on ability of students and ensure that they can acquire the necessary skills in practical operations.

Through case studies, laboratory practice, and on-site exercises, students' practical skills are improved. For example, the use of emergency communication vehicles for practical training allows students to understand the specific applications of the equipment.

- (9) Create an interactive learning environment: Encourage students to ask questions and discuss in class, and improve their participation and cooperation through cooperative group learning. Explain the specific requirements of emergency communication for networks and equipment, such as network flexibility, rapid deployment, miniaturization, energy efficiency, ease of operation, and good service quality assurance. Through analysing the application cases of emergency communication in actual disaster response, such as the drone emergency communication guarantee program in the Henan floods, students will understand the application of theoretical knowledge in practice.

- (10) Focus on individual student differences: Personalized teaching support is provided to help each student make progress, based on their different learning styles and ability levels.

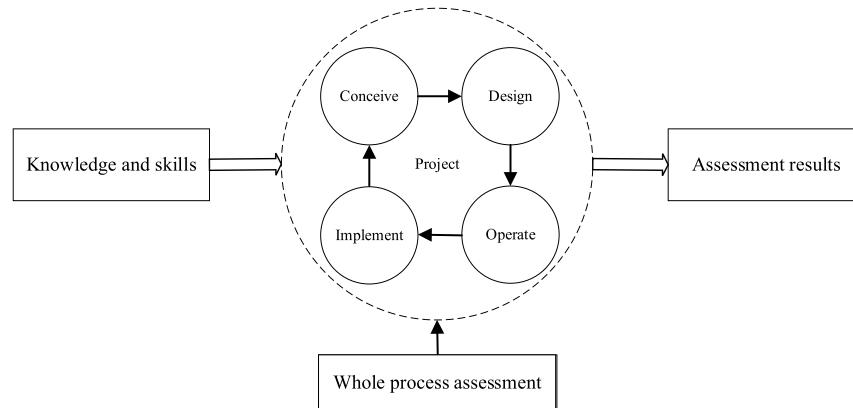
Through the above measures, the teaching quality of emergency communication courses can be effectively improved, students' interest in learning can be stimulated, and their professional skills and practical ability can be enhanced.

#### **4. OBE-CDIO-based teaching model for emergency communication**

Aiming at the teaching characteristics of the emergency communication system, combined with the OBE output requirements and CDIO process-led teaching ideas, the innovative teaching mode based on OBE-CDIO is proposed to adapt to the talent training objectives of the emergency communication system. The OBE-CDIO teaching mode is shown in **Figure 1**, which consists of the knowledge and skills, specific projects, whole-process assessment, and the assessment results. The knowledge and skills that students need to master through the study of the course are taken as input, the whole process assessment is carried out through the execution of specific projects, and the output is the result of the systematic assessment method. Emergency tasks, as a single project, form a teaching cycle, by using multiple tasks with the same knowledge and splitting different knowledge to form a multi-cycle chain, constituting the entire OBE-CDIO emergency communication teaching mode. In each segment of OBE-CDIO, the teacher guides the students through the instructional design to conceptualize and design the product attributes, such as what software and hardware the system needs to output consists of and what functions it can realize, and finally, realize and run the designed system. The meanings of the components are as follows:

- (1) Project. Aiming at specific practical projects, set up project groups containing most of the main teaching contents according to the teaching requirements of emergency communication. Teachers explain the relevant knowledge in the classroom and guide students to complete the practical objectives of the projects. Unlike the existing project teaching mode in which students are required to master the relevant knowledge base on their own, the basic content of teaching in OBE-CDIO is still led by teachers in the classroom, which helps to improve the average learning efficiency of students' classroom learning.
- (2) Conceive. After setting up project clusters, each project relies on the development process of an emergency product. The form, attributes, performance, and realized functions of the product are first conceptualized. Learning is done after listing all the product attributes one by one. At this stage, the teacher needs to prepare all the attributes of the product and related teaching content in advance. After students complete the conception of the product, timely supplement the content that students have not considered, and at the same time expand the corresponding professional basic knowledge. Different

from the existing teaching mode, OBE-CDIO pays more attention to the teacher's control of classroom dynamics in the classroom and can correct the unsatisfactory teaching atmosphere at any time. It is more conducive to teaching reform experiments and prevents students from feeling the abruptness of the teaching content or the discomfort of the teaching method.



**Figure 1.** OBE-CDIO based teaching model for emergency communication.

- (3) Design. After completing the conception, according to the attribute requirements of the emergency communication product and the project objectives, students design the product, including the specific implementation steps, what kind of tools to use, including hardware, software, and professional process, product compliance requirements, etc. If the product is an APP, the design includes programming language (Python, C, Java, etc.) selection, hardware platform performance configuration, algorithmic process, realization of the function, and so on. In short, it is the design of the specific process steps for the production of the product. At this stage, the teacher needs to prepare relevant process methodology teaching and a standard reference example in advance, while paying attention to the scalability of the example, to help students realize the personalization of the design. Reminders are given on factors that may lead to failure. This part is demanding and requires that students be prepared beforehand to efficiently complete the required product design.
- (4) Implement. After the design is completed, the implementation verifies the product design. A feasible design completes the output of the result through the implementation. In contrast, a defective design will result in a non-ideal output. Feasible product designs are distinguished into different grades based on the variability of the realized output, i.e., failed, feasible, reasonable, and preferred. The corresponding grades are assigned to the students' realizations, and the designers are assigned the corresponding marks. The realization component strengthens the assessment of the students and increases their initiative more effectively.
- (5) Operate. The main elements that operate in OBE-CDIO are the evolution of the implementation improvements and technical support. The main embodiment of the product realization through the previous stage, and at the same time, based on feedback, to decide whether the product needs to be upgraded and improved. All products require technical support, with the instructor playing the role of the consumer to examine the product and provide feedback on the application of the product, and the student giving the appropriate technical response or demonstration at a specified time. Similar to the realization phase, this phase also provides suggestions for assessment methods.

The OBE-CDIO model combines the experimental character of teaching reform at the primary level,



improves the weakened dominance of teachers in the existing active teaching mode, and enables teachers to better revise the development direction and presentation effect of teaching. Students are better able to adapt to the change in teaching methods under the OBE-CDIO teaching model, and differences in learning bases are not magnified as a result. Teachers in the conception and design phase of the basic teaching of emergency communications ensure the integrity of the knowledge in the classroom, laying a knowledge foundation for students to design. In the stage of realizing the implementation phase, the teacher switches from the dominant mode to the guiding mode, which activates the students' innovativeness and prompts them to think on their own.

## 5. Teaching cases and effectiveness analysis

In the teaching of emergency communication systems for communication engineering majors, the total credit hours are 32 credit hours, of which 24 credit hours are theoretical and 8 are practical. OBE-CDIO teaching mode is applied to the teaching of the emergency communication system, and the allocation of credit hours and the corresponding teaching contents are shown in **Table 1**.

**Table 1.** Emergency communications systems credit hours allocation and instructional content

Project chain	Conceive	Design	Implement	Operate
Overview of emergency communications	1C	1D	0	0
Satellite emergency communications	2C	2D	0	0
Wireless emergency communications	1C	1D	1I	1O
Mobile emergency communications	2C	2D	0	0
Network emergency communications	1C	1D	1I	1O
Mine rescue communications	2C	2D	1I	1O
Integrated emergency communication	2C	2D	1I	1O
Underwater emergency communications	1C	1D	0	0
Total	12	12	4	4

Since the “air, sky, earth, and well” integrated emergency communication takes up nearly 20% of the total content, the allocated hours are 6 hours (4 theory hours + 2 practical hours). It includes three parts: a high-altitude mobile stationary communication carrier, a satellite emergency communication vehicle, and an “air, sky, earth, and well” integrated emergency communication platform. Through the establishment of three projects for these components, the theoretical knowledge involved is interspersed into the process of emergency rescue, and the teacher guides the students to think about how to accomplish the goal of emergency communication from conception and design in the classroom. The realization and operation phases are planned to be completed in unison, simulating the production practice of emergency rescue in mining operations. The high-altitude mobile stationing emergency platform, “Static Communication” satellite emergency communication vehicle, and “Dynamic Communication” satellite emergency communication vehicle will achieve the management of emergency operations and resource scheduling, providing timely feedback on the emergency business needs, and rationally utilize the system's emergency resources (Including emergency command vehicles, satellite communications equipment, trunked communications equipment, mobile communications equipment, etc.), to ensure the availability of communications before the repair of traditional public communications services, and to



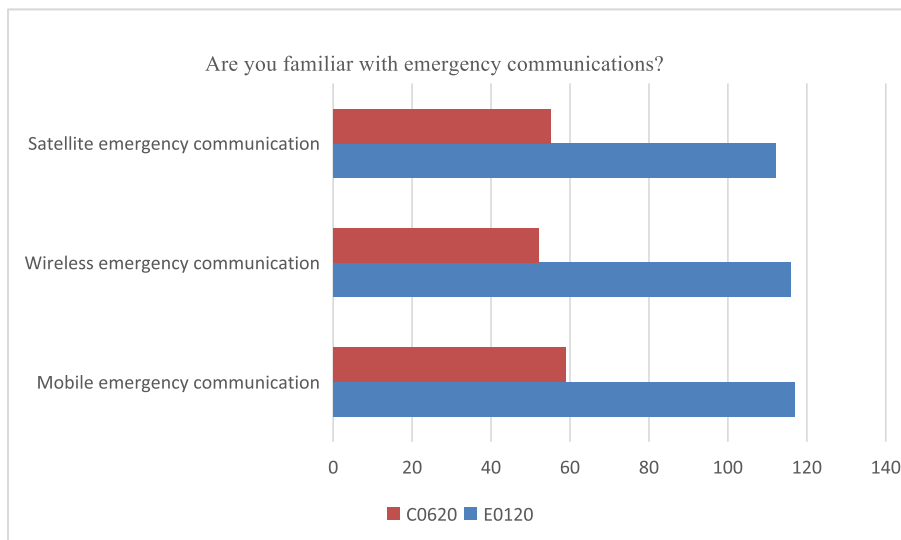
select the appropriate means of emergency communications as far as possible according to actual business needs, to improve the effectiveness of communications.

At the beginning of the practical, students work in groups of 5. Mainly through the division of labour and cooperation in the implementation and operation stages to complete corresponding tasks. To verify the teaching effectiveness of OBE-CDIO emergency communication, the assessment does not use the traditional way of exam plus usual grades, but evaluates each project to avoid too much influence on the total assessment results due to a certain failure. The total score for each sub-project is 100 points, with each stage accounting for 25%, thus comprehensively examining the learning effect of students' theory and practice.

E0120 (emergency management) and C0620 (communication engineering) of class 2020 were selected for teaching comparative analysis. A total of 61 students of E0120 were used as the control class to implement the traditional teaching mode; a total of 127 students of C0620 were used as the experimental class to implement the OBE-CDIO teaching mode, and taught by the same instructor. After one round of teaching, the application effect was investigated through a WeChat questionnaire, and a total of 159 people were obtained to participated in the survey of the mini-program, with a recovery rate of 84.6%.

### 5.1. Basic knowledge

The teaching mode reform is based on the fact that the teaching content must be executed following the syllabus to ensure the integrity of teaching. Therefore, we designed a self-assessment questionnaire on the mastery of basic knowledge to conduct a survey, so as to analyse the students' mastery of the teaching content under the two teaching modes, and the results are shown in **Figure 2**.



**Figure 2.** Survey on mastery of basic knowledge.

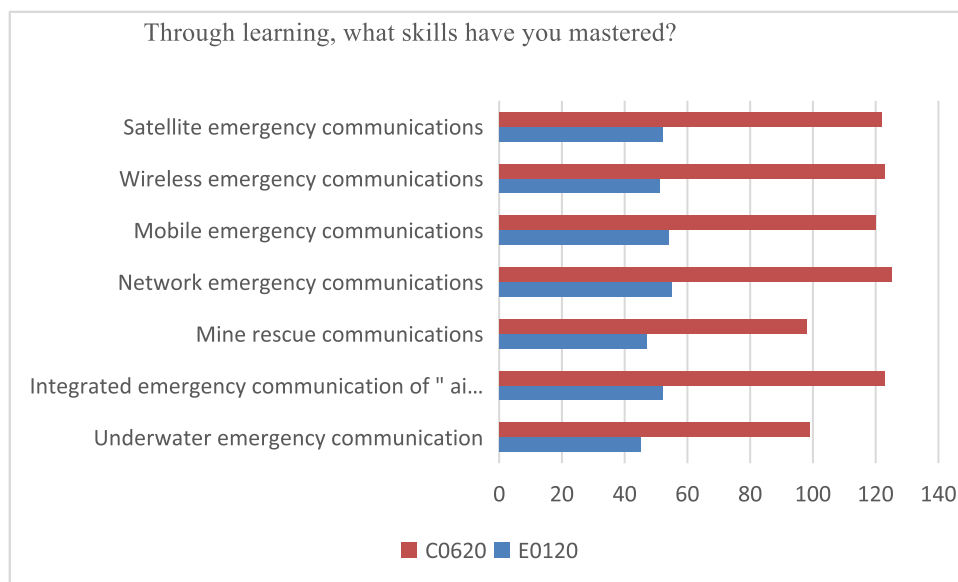
### 5.2. Skill mastery status

In the OBE-CDIO teaching mode, more attention is paid to the cultivation of skills, and points are assigned at each stage to judge the mastery of students' skills. Emergency communication skills mainly include satellite emergency communication, wireless emergency communication, mobile emergency communication, network emergency communication, mine rescue communication, "air, sky, earth, and well" integrated emergency communication, and underwater emergency communication. For comparison, students' self-assessments were also used for analysis, and the results are shown in **Figure 3**. In terms of theoretical knowledge and experimental

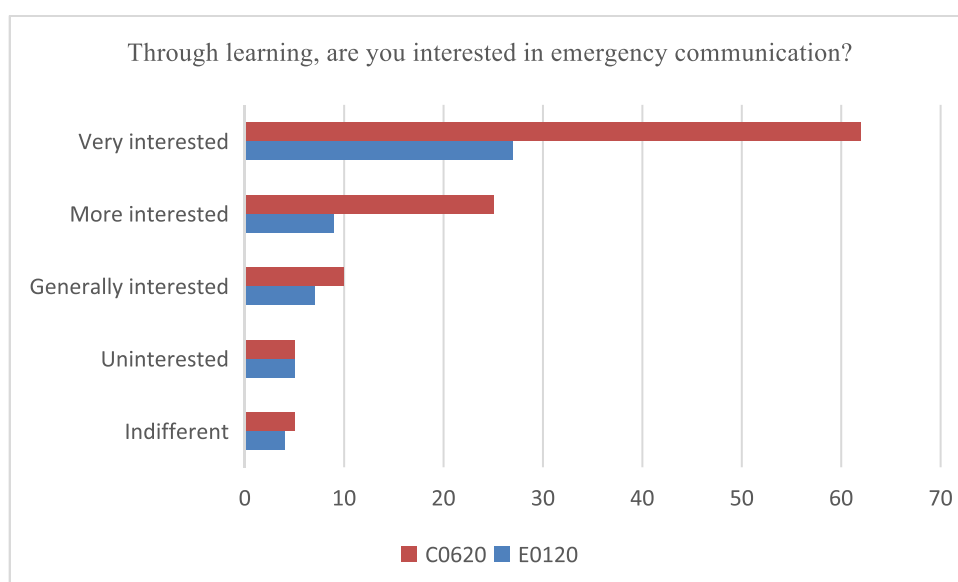
operation skills, both teaching modes can play a better role; in terms of expanding skills, such as hardware line connection, man-on-a-street task execution, and comprehensive business processing, students in the experimental class show stronger confidence.

### 5.3. Interest in learning

Interest is the best teacher and the motivation for students to learn independently. A good teaching mode not only improves the teaching effect but also stimulates students' interest in learning, building a positive cycle of "learning - realizing - learning again". The investigation on the impact of the change of teaching mode on learning interest is shown in Figure 4, which shows that the application of the OBE-CDIO teaching mode can obviously increase students' interest in emergency communication.



**Figure 3.** Questionnaire survey on skill mastery.



**Figure 4.** Questionnaire on learning interests.

From the survey, it can be found that the OBE-CDIO model brings new learning experiences to students, and most students tend to accept modern teaching methods and prefer to utilize new tools, such as WeChat applets and official accounts, to communicate and learn. In the subsequent teaching process, we will continue to study the application of the OBE-CDIO teaching model, expand the scale of the reform test subjects, and make the test results more reasonable and credible.

## 6. Conclusion

Considering the rapid pace of updates in the modern communication industry and combined with the teaching conditions of higher education institutions, the OBE-CDIO teaching mode is proposed to promote students' understanding of the field of emergency communication and improve their professional skills, to reduce the extra learning costs when they are employed. At the same time, the OBE-CDIO teaching model requires teachers' professional skills to be greatly improved, and the novel and practical teaching content can greatly increase students' interest in learning and ultimately achieve the combination of industry and education and foster the growth of teaching and learning.

Teaching practice has proven that the OBE-CDIO model implements an integrated curriculum program. This program is both an engineering education implementation framework and an open engineering education concept. In practice, it can be used to build a fruitful new model of engineering education by strengthening exploration in both theory and practice concerning the different characteristics of each specialty. Taking the practical teaching reform in the emergency communication course module as an entry point, it integrates and optimizes the existing teaching and practice content, and we have established a four-dimensional integrated engineering practice teaching system, and also promotes the multi-dimensional cooperation mechanism of "industry-university-research-use".

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# Exploration on the Path of AIGC Empowering College English Writing Teaching

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**Abstract:** With the in-depth implementation of educational reform, college English writing teaching should also keep pace with the times, focusing on AIGC empowerment to improve the effectiveness and efficiency of talent cultivation, enabling students to comprehensively apply their professional knowledge to engage in related work after graduation. To enhance its empowering effect, it is necessary to understand its advantages in higher vocational English writing teaching, and while making full use of these advantages, explore the empowerment paths, so as to provide useful references for front-line teachers.

**Keywords:** AIGC; English writing; Teaching reform; AI education; College English

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## 1. Introduction

The digital transformation of global higher education is accelerating. According to the Education Informatization 2.0 Action Plan issued by the Ministry of Education, the coverage rate of artificial intelligence (AI) applications in education had reached 67% by 2023. AIGC technologies (such as ChatGPT and Wenxin Yiyan) have demonstrated outstanding capabilities in text generation, grammar correction, and style imitation, bringing new opportunities to English writing teaching. The emergence and application of AIGC technologies help vocational colleges break through the bottlenecks of traditional English writing teaching, such as “long correction cycles” and “insufficient personalization.” They also facilitate the exploration of a new human-machine collaborative teaching model, which aligns with the concept of “technology empowerment and equal emphasis on learning and teaching” proposed in the College English Teaching Guidelines (2023 Edition).

## 2. Problems in English writing teaching in higher vocational colleges

### 2.1. Insufficient teaching staff

English teachers in higher vocational colleges generally face the problems of heavy teaching tasks and an imbalanced teacher-student ratio, making it difficult to personalize writing teaching. Many teachers have to take



on teaching work for multiple classes at the same time, and thus cannot conduct detailed correction and guidance on each student's composition. In addition, some teachers lack systematic training in writing teaching, especially in professional fields such as academic English and practical writing, and their experience is insufficient, making it difficult to meet the needs of students from different majors <sup>[1]</sup>. The introduction of AIGC technology can assist teachers in automatically correcting grammatical errors and providing suggestions for sentence pattern optimization, thereby reducing their workload. This allows teachers to devote more energy to cultivating high-level writing and thinking, such as logical construction and cross-cultural expression <sup>[2]</sup>.

## **2.2. Lack of teaching resources**

Traditional English writing textbooks for higher vocational colleges have a single content, mostly focusing on template-based exercises, and lack writing cases in real workplace scenarios, resulting in a disconnect between what students learn and actual needs. At the same time, the English writing resources in school libraries or online databases are limited, making it difficult to support students' independent learning <sup>[3]</sup>. AIGC can dynamically generate diversified writing materials, such as business emails, technical reports and other professional texts, and customize cases based on students' professional backgrounds to make up for the shortage of teaching resources. In addition, AI-driven interactive writing platforms can provide real-time feedback to help students improve their writing skills through repeated revisions <sup>[4]</sup>.

## **2.3. Weak foundation of students**

The English proficiency of students in higher vocational colleges varies greatly. Problems such as limited vocabulary and frequent grammatical errors directly affect the quality of writing. Some students have a fear of writing due to the long-term influence of exam-oriented education and lack confidence in expression. AIGC tools can lower the threshold for writing through functions such as intelligent error correction and vocabulary association. For example, they can prompt grammatical correction suggestions in real time or recommend more authentic expressions. At the same time, AI-generated progressive exercises (such as expanding from sentences to paragraph cohesion) can help students gradually build writing confidence and adapt to tasks of different difficulties <sup>[5]</sup>.

## **2.4. Outdated teaching methods**

Currently, English writing teaching in higher vocational colleges still mainly follows the traditional mode of "teacher's lecture - students' imitation - mechanical correction", with poor classroom interaction and low student participation <sup>[6]</sup>. Writing tasks are mostly isolated exercises, lacking task motivation in real contexts, leading to students' low interest. AIGC can promote the innovation of teaching methods. For example, it can enhance the practicality of writing through virtual scenario simulation (such as AI acting as a customer asking students to write English proposals); or use big data to analyze students' common mistakes, helping teachers design targeted training. In addition, AI-supported collaborative writing platforms can promote mutual evaluation and assistance among students, stimulate their learning initiative, and realize the transformation from "passive input" to "active output" <sup>[7]</sup>.

# **3. Advantages of AIGC empowering higher vocational English writing teaching**

## **3.1. Conducive to creating a real language environment**

Situated Cognition Theory holds that individuals gradually form an understanding of knowledge and mastery

of skills in the process of interacting with the surrounding environment. In a situation, students are no longer passive in receiving information, but can interact with the environment, learn knowledge and master skills in the interaction <sup>[8]</sup>. AIGC can create a new language environment for students, and this environment has high authenticity, allowing them to preview, practice and review in this situation, thus cultivating students' contextual awareness while improving their sensitivity to the situation. AIGC also has a language input function, which can guide students to accumulate vocabulary, and at the same time, help them learn grammar and other knowledge, laying a foundation for them to understand the ways and methods of language use, so that students can flexibly use language in different situations and cultivate their contextual awareness; In addition, higher vocational English teachers can also guide students to use AI's chat assistant function, let them ask questions about their difficulties and doubts, discuss and communicate with their peers, and organize students to express in language based on real situations; Based on AI's interactive function, it is easy to improve students' comprehensive abilities such as language application and situation adaptation <sup>[9]</sup>.

### **3.2. Conducive to providing writing suggestions**

Some people describe AIGC as a writing teacher for students. Coupled with its own advanced technologies, such as deep learning technology, this teacher can quickly diagnose students' English compositions and give timely feedback <sup>[10]</sup>. That is, AIGC can process a large number of texts in a very short time and provide students with detailed feedback. In addition, AI can also provide writing suggestions based on students' writing content and style; Analyze the type of writing and provide writing skills to help students get through the writing barrier. These suggestions can enable students to understand their shortcomings in writing, lay a solid foundation for their subsequent improvement, and also enrich their language expression methods and improve their writing level <sup>[11]</sup>.

### **3.3. Conducive to providing timely feedback**

AIGC can evaluate students' writing quality in a very short time and give timely feedback, so that students can get AI's review without waiting for too long, which is convenient for timely improvement <sup>[12]</sup>. It can be said that the speed of AI feedback has greatly improved students' enthusiasm for writing, enabling them not only to understand their strengths and weaknesses in writing, but also to perceive progress, which is conducive to improving their confidence in English learning. In particular, the guidance provided by AI is highly personalized, which is conducive to meeting students' diversified learning needs. With the guidance and help of AI, students can obviously perceive the changes in their writing level, which is conducive to cultivating their learning self-confidence and stimulating their learning interest <sup>[13]</sup>.

## **4. Paths for AI to empower higher vocational English writing teaching**

### **4.1. Strengthening writing foundations based on intelligent environments**

One major way for AI to empower higher vocational English writing teaching is to build an intelligent environment. Influenced by traditional educational concepts, some higher vocational English teachers often focus their teaching on theoretical knowledge while neglecting the cultivation of students' writing skills. The application of AI technology can create real writing scenarios, such as composing emails and writing reports, to improve students' writing proficiency through practical exercises <sup>[14]</sup>. This practical approach not only enriches students' writing experience but also enhances their ability to identify, analyze, and solve problems, laying a solid foundation for their subsequent learning.

For example, higher vocational English teachers can assign a themed essay, such as “Environmental Protection,” and create a new, highly intelligent learning environment for students, making them feel as if they are at an academic conference or participating in a project report, where they need to write English papers or reports on the theme. The use of intelligent platforms provides a solid foundation for teachers to achieve their teaching goals. First, students are guided to read environmental protection-related cases and research reports on the platform, helping them quickly understand environmental issues. During this process, teachers can guide students to make full use of the platform’s functions to obtain information and accumulate writing materials<sup>[15]</sup>.

Second, with the help of the intelligent platform, writing scenarios is created. Teachers can divide students into several groups, allowing them to learn, communicate, and explore in groups. In practice, around the environmental protection theme, different topics can be assigned to each group; for example, some groups are responsible for climate change, while others focus on garbage classification. On this basis, students’ tasks are clarified: to write English papers or reports in this environment to express their views on the topics. In the writing process, students should make full use of the platform’s auxiliary functions, such as grammar checks, correction of spelling errors, and provision of improvement suggestions. Third, AI’s evaluation function is utilized, with AI acting as an evaluator to comment on students’ works and provide revision suggestions. Teachers can guide students to carefully analyze the evaluation feedback, identify errors, and revise them promptly. In short, the functions of AIGC should be fully utilized to improve students’ writing skills.

Finally, defenses are organized through the intelligent platform. AI acts as a jury, asking questions about students’ English works and requiring them to answer in English. This exercise helps students practice their English defense skills and enhance their learning confidence.

#### **4.2. Blended learning: online + offline for complementary advantages**

To give full play to the empowering effect of AIGC, a blended learning model, combining online and offline methods, can be adopted to allow artificial intelligence and teachers to leverage their respective strengths and enrich students’ learning experience. For the online learning part, teachers can guide students to use the tool for self-assessment. In fact, AIGC can conduct intelligent analysis based on the learning data generated by students during their study and recommend learning resources, such as writing exercises, according to their writing level, to improve their writing proficiency in a targeted manner. On this basis, teachers should focus on building offline classes into creative places and main positions for students’ writing practice. In teaching design, teachers should design activities that students love, such as group discussions and interesting continuation of stories, based on students’ online learning status, and create an atmosphere where students can speak freely and engage in in-depth interactions. This model not only makes teaching more humanistic but also gives full play to the advantages of artificial intelligence, which is conducive to improving students’ learning efficiency and effectiveness.

#### **4.3. Carrying out personalized teaching to improve tutoring efficiency**

Personalized teaching aims to pursue uniqueness in teaching. In this teaching model, both teachers and teaching have undergone some new changes; for example, the role of teachers has fundamentally changed from knowledge transmitters to guides and teaching customizers. Relying on AI technology, teachers can fully understand and analyze students’ writing levels, writing habits, and personal preferences, so as to formulate tutoring plans that are more in line with students’ actual needs.

For example, when teaching argumentative essays, teachers can first use the AI system to conduct in-depth analysis of students’ works, including their arguments, supporting evidence, and logical structure, and then

formulate teaching plans. For students who have vague arguments, teachers can focus on cultivating their logical thinking, as well as their critical and divergent thinking. In practice, teachers can use the AI system to push training tasks to students, such as organizing them to write commentaries on current social hotspots, guiding them to sort out their views and build frameworks. For students who lack sufficient and persuasive arguments, teachers can use the system's database to guide them to master the methods of collecting and screening evidence and effectively integrating it into their articles to better support their arguments. Teachers can also use the system's feedback function to understand students' writing levels, progress, and dynamics.

For instance, during a writing task, if the AI system finds that a student has problems such as incorrect reasoning and unclear arguments, teachers should provide targeted guidance based on the real-time feedback. First, guide the student to sort out their reasoning ideas to clarify the main points of the argument, then provide argument structures and guide them to apply them effectively, thereby improving the scientificity of their arguments. This teaching model not only helps improve students' writing ability but also elevates teachers' teaching level to a new height.

#### **4.4. Group learning to create a suitable writing environment**

The successful implementation of AIGC-empowered college English writing teaching is inseparable from scientific teaching methods. Therefore, teachers should scientifically group students based on an analysis of their writing levels, so that group members can complement each other while engaging in healthy competition. To enhance students' participation, enthusiasm and cooperation ability, teachers can set systematic tasks for them, such as "My Ideal" and "Environmental Protection Is Urgent," and advocate group creative competitions. For example, the iWrite writing platform can be used to enable peer evaluation, and a corresponding evaluation mechanism can be established. On this basis, teachers can guide students to submit their work to the platform, and while receiving feedback from the platform, they should also pay attention to evaluations from teachers and peers. In the initial evaluation, AI technology is used to assess grammatical and sentence-structure issues in the works; peer evaluation mainly focuses on content creativity, which not only guides students to appreciate works but also helps them learn how to review articles; teacher evaluation will integrate the above feedback and put forward improvement suggestions.

### **5. Conclusion**

In conclusion, the emergence and application of AIGC have brought about earth-shaking changes in English writing teaching. While improving the efficiency of teaching and learning, it has also created favorable conditions for personalized and customized teaching. The application of AIGC makes writing teaching more targeted, efficient, and scientific. It not only cultivates students' innovative awareness but also greatly contributes to the development of their core English literacy. The iterative update of information technology has made the enabling effect of AI more and more prominent. While promoting teaching innovation, it can also lead to the reform of concepts and the innovation of talent training models, which is conducive to meeting society's demand for high-quality talents.

### **Disclosure statement**

The author declares no conflict of interest.



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# Research on the Mechanism of Enhancing the Attractiveness of Ideological and Political Courses in Higher Vocational Colleges in the Digital-Intelligent Era

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**Abstract:** Ideological and political courses are key courses for cultivating morality and nurturing talents in higher vocational colleges. Exploring reform strategies for ideological and political courses in higher vocational education in the digital-intelligent era serves as a breakthrough to enhance the attractiveness of classroom teaching and strengthen students' comprehensive abilities. Against this backdrop, higher vocational colleges and ideological and political teachers need to base themselves on reality, conduct in-depth analysis of the connotation of digital intelligence, address the restrictive factors existing in current classroom teaching, and apply digital-intelligent technologies to build a new education mechanism. This will form an integrated education pattern combining "digitalization + tradition," thereby enhancing teaching attractiveness. This paper studies and analyzes the mechanism of enhancing the attractiveness of ideological and political courses in higher vocational colleges in the digital-intelligent era and puts forward corresponding viewpoints.

**Keywords:** Digital-intelligent era; Higher vocational colleges; Ideological and political courses; Attractiveness enhancement; Research

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## 1. Introduction

In the context of the new era, digital technologies such as artificial intelligence and blockchain are developing rapidly, providing effective technical support for the reform of higher education <sup>[1]</sup>. Ideological and political courses in higher vocational colleges assume important responsibilities such as educating people, nurturing the soul, and shaping aspirations. Integrating new technological means with the teaching of ideological and political courses can continuously enhance the attractiveness of classroom teaching, help teachers build an "interest-stimulating" teaching environment, and thus promote high-quality development of teaching <sup>[2]</sup>. Therefore,

in this context, higher vocational colleges and ideological and political teachers need to further adjust talent training goals and apply digital-intelligent technologies to optimize teaching plans, to carry out efficient teaching activities and effectively strengthen students' core competitiveness<sup>[3]</sup>.

## **2. Intrinsic value of building a mechanism to enhance the attractiveness of ideological and political education in the digital-intelligent era**

### **2.1. Meeting the needs of digital economy development**

At this stage, China's social economy is developing rapidly. The country has formulated new development plans focusing on the upgrading and optimization of the economic system, proposing the need to build a digital economic system<sup>[4,5]</sup>. Especially in recent years, the scale of China's digital economy added value has continued to rise, accounting for an increasing proportion of total GDP<sup>[6]</sup>. It is not difficult to see from this that the digital economy will be an important direction of social development in the future. Its overall development requires comprehensive and innovative theories and thinking to provide theoretical, technical and talent support for breaking through development constraints. Under this demand, skilled talents in higher vocational colleges also need to have a certain digital thinking. By applying new technical means to carry out teaching activities and optimize talent training programs, schools and teachers can continuously improve students' digital capabilities, enabling them to develop into digital talents of the new era while having solid cultural accomplishments.

### **2.2. Enhancing the targeted nature of ideological and political courses**

From the perspective of traditional teaching, ideological and political teachers mainly carry out classroom teaching activities focusing on teaching priorities and contents. Although this method can ensure the teaching progress, it cannot ensure that students are fully engaged in the learning process, that is, classroom teaching lacks targeting and attractiveness. To address this issue, in the digital-intelligent era, higher vocational colleges continuously improve teachers' information literacy, enable teachers to master necessary digital teaching capabilities, and build intelligent teaching and human-computer interaction platforms. This can lay a good foundation for the effective implementation of subsequent teaching activities and help students internalize the teaching content into their actions. At the same time, teachers' application of AR and AI technologies to design teaching plans and innovate teaching models can create an interesting and comprehensive classroom environment, which can significantly enhance classroom attractiveness and fully reflect students' subjectivity<sup>[7]</sup>.

### **2.3. Improving the precision of ideological and political teaching**

The application of new technologies helps to effectively improve the precision of classroom teaching, enabling a timely grasp of students' learning progress and ideological trends. For example, teachers can use new technical means to collect and provide feedback on students' classroom demands in a timely manner, and also keep track of students' behaviors and ideological trends. With these data, teachers can promptly understand students' learning progress and knowledge mastery, and then further optimize teaching content and adjust teaching directions to implement precise teaching activities<sup>[8]</sup>. For instance, when explaining content related to the "Belt and Road Initiative," teachers can accurately push learning materials to let students understand the current development status of China's economy and culture under this strategy, which can deepen students' understanding of knowledge. Meanwhile, teachers' application of smart classrooms and online-offline interaction can also optimize students' learning experience to a certain extent, improve the precision and targeting of teaching, and thus avoid

deviations in teaching activities.

### **3. Restrictive factors for development in ideological and political theory teaching in higher vocational colleges at the current stage**

#### **3.1. Incomplete curriculum system setup**

Ideological and political courses in higher vocational education have strong theoretical and practical characteristics. However, the curriculum system setup in some schools has not fully kept up with the times, and some teaching content has become disconnected from the development of the era <sup>[9]</sup>. Meanwhile, against the background of digital intelligence, some schools have not incorporated courses related to the digital economy into their curriculum systems. This indicates significant limitations in talent training programs, resulting in a mismatch between the comprehensive abilities of trained talents and the needs of social development.

#### **3.2. Lack of clear talent training objectives**

In the current teaching of ideological and political courses in higher vocational colleges, the status quo of talent training has not fully adapted to the rapid development of new technologies, new industries, and new business forms <sup>[10]</sup>. This shows that against the background of digital intelligence, the objectives of talent training in ideological and political courses are not clear, lacking pertinence and forward-looking. Specifically, with the continuous progress of science and technology and the continuous upgrading of industries, new business models and economic forms are emerging. Higher vocational colleges have not been able to promptly keep up with external changes in aspects such as the setup of ideological and political education courses, the innovation of teaching models, the optimization of teaching plans, and practical links. This has led to a certain degree of disconnection between the knowledge structure and skills of trained talents and market demand, which not only affects the employment quality of graduates but also restricts the pace of innovation and development in the economic field.

### **4. Mechanisms and strategies to enhance the attractiveness of ideological and political courses in higher vocational colleges in the digital-intelligent era**

#### **4.1. Continuously optimizing existing teaching systems with digital-intelligent technologies**

In the digital-intelligent era, efficiently cultivating skilled talents adaptable to digital-intelligent environments has become a key issue in the educational development of higher vocational colleges <sup>[11]</sup>. Continuously optimizing talent cultivation systems against the backdrop of digitalization ensures the smooth implementation of subsequent teaching activities. First, ideological and political teachers in vocational colleges must conduct thorough research to gain a deeper understanding of the current status of professional teaching, as well as the requirements for talents' comprehensive abilities, job project standards, and other criteria in relevant positions amid digital transformation. Based on this, they should adjust teaching plans. On the premise of explaining basic knowledge, professional teachers should integrate knowledge and skill points from enterprise production into classroom teaching. For example, teachers can align courses with job positions according to teaching needs, decompose course knowledge points around different teaching contents, guide students to operate digital hotel management projects, and cultivate students' diverse abilities, thereby promoting the development of their innovative capabilities and professional literacy <sup>[12]</sup>. Second, colleges should reorganize and optimize basic knowledge

teaching systems covering digital economics, artificial intelligence applications, big data principles, and blockchain applications based on practical needs, ensuring that teaching content aligns with economic and social development. They should also continuously improve existing digital economy course systems, clearly defining course categories, names, teaching objectives, and teaching plans. Third, while developing, colleges should simultaneously build virtual simulation resource libraries, develop VR/AR projects such as digital exhibition halls of red education bases and smart factory training, and construct a progressive course system of “theoretical micro-courses—scenario simulation—real-world practice” through platforms like Chaoxing Learning Pass. In terms of teaching model innovation, a hybrid teaching method should be implemented: online teaching spaces use platforms like Zhihuishu for independent theoretical learning and intelligent assessment, with knowledge graph technology recommending personalized learning paths; offline practice spaces rely on virtual simulation workshops to create a “golden course” teaching environment, thereby improving the existing teaching system and fully leveraging the value of digital-intelligent teaching tools.

## **4.2. Clarifying talent cultivation goals with digital-intelligent technologies**

First, considering the current status of ideological and political course teaching, schools and teachers should use big data technology to conduct in-depth analyses of the digital transformation trends of regional industrial chains at the goal-setting level. They should rely on natural language processing technology to parse job competency standards, extract core competencies covering digital economy thinking, intelligent technology application, and business ethics judgment, and form a dynamically adjustable talent cultivation goal plan<sup>[13]</sup>.

Subsequently, teachers need to further clarify talent cultivation goals: In terms of curriculum system planning, break down traditional disciplinary barriers and build a modular curriculum structure consisting of “general literacy courses (principles of economics + digital citizenship education), professional core courses (intelligent finance + blockchain applications), interdisciplinary expansion courses (business data analysis + artificial intelligence ethics).” In terms of cultivation paths, create a three-stage progressive model of “classroom training (virtual simulation platforms)—on-campus workshops (smart business sandboxes)—enterprise classrooms (AR live teaching).” In terms of quality assurance goals, develop a digital profiling system using learning analytics technology to track students’ progress in knowledge acquisition, skill transfer, and professional attitudes in real time.

## **4.3. Innovate teaching models under digital intelligence based on current situation**

### **4.3.1. Integration of online and offline teaching**

Against the backdrop of digital intelligence, the emergence of new technologies can provide technical support for ideological and political teachers in their teaching activities. To effectively deepen the reform of ideological and political teaching, teachers can adopt forms such as MOOCs and micro-courses, transform ideological and political education content into small stories, or play public welfare short films, etc., to arouse students’ interest in participation and encourage them to take the initiative in the learning process. Moreover, ideological and political teachers can carry out teaching activities with the help of blended teaching methods<sup>[14]</sup>. For example, in the teaching of knowledge related to College Students’ Career Planning, teachers can use blended teaching methods and offline task-based teaching methods to achieve the goal of ideological and political infiltration. To maximize teaching effectiveness and infiltrate ideological and political education, teachers can integrate relevant teaching materials before class, design them into micro-courses, self-learning cases, learning processes, etc., and also include cases of outstanding graduates from previous years to help students clarify their development



direction and cultivate their sense of competition. Then, teachers upload the relevant content to the learning APP, and students scan the QR code to enter and study. Through the communication module of the APP, students can communicate with each other, while teachers integrate students' learning situations and identify their learning difficulties in this process. In the subsequent offline teaching, teachers mainly focus on students' weak points in learning and carry out targeted teaching activities to help students clarify their positioning, implement ideological and political education, and improve the overall teaching effect.

#### **4.3.2. Innovate practical teaching forms**

Higher vocational ideological and political courses have strong practicality, so teachers can rely on new technical means to innovate practical teaching forms, thereby enhancing the attractiveness of teaching <sup>[15]</sup>. For example, in the project teaching of "Inheritance of Local Intangible Cultural Heritage", teachers can actively cooperate with local cultural centers and intangible cultural heritage inheritors to jointly determine cultural themes suitable for students' practice (such as traditional paper-cutting, local operas, etc.). Then organize students into research groups of 3-5 people, use mobile phone APPs to film and record the inheritors' skill demonstrations, and establish a digital cultural archive through WeChat mini-programs; guide students to use video editing software to produce cultural micro-courses in the training room, and conduct surveys on the community's awareness of traditional culture using Questionnaire Star; build an "online + offline" display platform, organize students to perform intangible cultural heritage skills through Douyin live broadcasts, and make interactive cultural maps using new technologies. For instance, when students learn about woodblock New Year paintings, they need to conduct on-site interviews with inheritors to master the production techniques, and also collaborate to complete the digital design of New Year painting elements, and finally hold an inter-professional works exhibition in the smart classroom. This teaching method decomposes cultural inheritance into specific tasks such as research recording, digital transformation, and communication practice, which not only exercises students' ability to apply information technology, but also strengthens cultural identity through personal participation, making ideological and political education truly "alive".

#### **4.4. Construct a teaching evaluation system involving intelligent technology**

The traditional evaluation of ideological and political education mainly relies on teachers' assessment based on students' final exam scores. However, this method is relatively simplistic, which is not conducive to teachers' grasping students' learning situation, and it is also difficult for students to understand their own shortcomings in learning. In response to this situation, from the perspective of ideological and political education and the application of digital intelligence, higher vocational ideological and political teachers should use new technologies to pay full attention to the students' learning process, evaluate their participation, learning ability, and mastery of knowledge based on feedback data. At the same time, teachers can also evaluate students' professional literacy and values, gradually establish students' learning confidence, and give play to the guiding value of curriculum-based ideological and political education. Students' mutual evaluation and group leaders' evaluation of students are conducive to reflecting the student-oriented approach and strengthening students' sense of ownership. With the help of online interaction means, parents and engineers from cooperative enterprises are encouraged to participate in the student evaluation process, thereby diversifying the evaluation subjects and further improving the pertinence and attractiveness of ideological and political education.



## 5. Conclusion

To sum up, the in-depth integration of digital intelligence technology with ideological and political teaching in higher vocational colleges can effectively improve students' practical ability, innovative thinking, and comprehensive ability<sup>[6]</sup>. In the context of digital intelligence, higher vocational colleges and ideological and political teachers need to base themselves on reality, conduct in-depth analysis of the connotation of digital intelligence and the necessity of teaching reform, and clearly identify teaching problems. Afterwards, colleges need to work with teachers to gradually optimize the teaching system, innovate teaching methods, etc., to give full play to the application value of new technical means, thereby enhancing students' core competitiveness and cultivating more high-quality technical talents for social and economic development.

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## Disclosure statement

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# Research on Mental Health Education Work of Vocational College Counselors from the Perspective of Positive Psychology

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**Abstract:** Against the backdrop of current social transformation and educational reform, college students are facing increasing psychological pressure, making mental health education an important part of higher education [1]. With the rapid development of the social economy and the popularization of higher education, the student population in vocational colleges has been expanding, and their mental health issues have gradually become a key topic in the field of education. As the core force in student management, vocational college counselors play an irreplaceable role in promoting students' all-around development and maintaining campus harmony and stability. However, in the face of the complex and changing psychological states of students and heavy work tasks, the mental health status of counselors themselves also deserves attention. Based on the theory of positive psychology, this study explores how to optimize the content and methods of mental health education work for vocational college counselors, so as to improve their psychological quality and better serve the growth needs of students.

**Keywords:** Vocational college counselors; Mental health education; Positive psychology

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## 1. Introduction

With the rapid development of the social economy and the popularization of higher education, the student population in vocational colleges has gradually expanded, and their mental health issues have attracted increasing attention. As the core force in student management work in vocational colleges, counselors play an irreplaceable role in promoting students' all-round development and maintaining campus harmony and stability. However, facing the complex and changing psychological states of students and heavy work tasks, the mental health status of counselors themselves is also worthy of attention. In this context, introducing positive psychology theory into the mental health education work of vocational college counselors not only helps to improve counselors' psychological quality but also better serves students' growth needs. This study aims to explore how to optimize the content and methods of mental health education work for vocational college counselors from the perspective

of positive psychology, thereby providing support for cultivating a healthier and more dynamic group of vocational college students.

## **2. Overview of positive psychology theory**

### **2.1. Basic concepts of positive psychology**

Positive psychology is a discipline centered on human happiness and potential. It emphasizes studying individuals' positive emotions, character strengths, and life meaning through scientific methods. Different from traditional psychology, which mainly focuses on diseases and defects, positive psychology pays more attention to tapping people's internal potential and helping them realize self-worth. For example, the "PERMA" model (Positive Emotion, Engagement, Relationships, Meaning, Accomplishment) proposed by positive psychologist Martin Seligman provides a clear framework for understanding the essence of happiness.

### **2.2. Application fields of positive psychology**

In the field of education, positive psychology is widely applied in teacher training, students' mental health counseling, and other aspects. Counselors are an important part of the teaching and management team in higher education institutions, as well as the organizers, implementers, and instructors of students' daily ideological and political education and management work, so they play an important role in college students' growth <sup>[2]</sup>. For vocational college counselors, positive psychology can provide them with a set of systematic tools and concepts, helping them face challenges in work with a more positive attitude and effectively guiding students to establish healthy thinking patterns. Constructing a developmental evaluation system for students in vocational colleges under the guidance of positive psychology is a key support for realizing students' positive growth <sup>[3]</sup>. For instance, cultivating students' sense of gratitude, optimistic attitude, and resilience can significantly improve their psychological state and enhance their learning efficiency and quality of life.

## **3. Problems in mental health education work of vocational college counselors**

### **3.1. Insufficient professional competence**

As the core force in class management, counselors' work effectiveness directly affects the class's learning atmosphere, academic quality, and, more profoundly, students' future growth trajectory. Therefore, in current class management, counselors should not only focus on class discipline and academic performance but also adhere to the student-centered educational philosophy and pay close attention to students' mental health <sup>[4]</sup>. However, at present, many vocational college counselors lack sufficient professional knowledge and skills in psychology. Without professional psychological knowledge and techniques, they often struggle in providing daily psychological assistance to students. For example, when some students suffer from depression, they may exhibit symptoms such as low mood and decreased interest in activities. If counselors have not received relevant professional training, they may mistakenly attribute these symptoms to academic difficulties, excessive exam pressure, or interpersonal issues with classmates, overlooking the possibility of depression. This can lead to missed opportunities for early intervention and seriously delay the best time for treatment.

Additionally, counselors face limitations in handling complex issues. Due to the involvement of sophisticated psychological knowledge, it is difficult for vocational college counselors to address students' problems such as anxiety, obsessive-compulsive disorder, or other mental illnesses. They also lack clarity on

issues such as whether to refer students to professional psychologists and the appropriate referral methods. Therefore, vocational colleges need to continuously strengthen the training of counselors' capabilities in mental health education.

### **3.2. Excessive work pressure**

Mental health is one of the key factors affecting the physical and mental well-being of vocational college students<sup>[5]</sup>. However, the heavy and complex workload often leaves counselors in a state of being overwhelmed. Routine student management, planning and organizing college activities, career guidance, and handling emergencies are all important parts of their daily work. Compared with these transactional tasks in daily student education and management, mental health education seems to be reduced to a "labor-intensive and time-consuming" task. For example, when the end of the semester or graduation season arrives, counselors will shift their work focus to matters such as student performance review, internship arrangements, and job recommendations, leading to insufficient attention to students' mental health status.

Job burnout refers to a state where counselors feel exhausted, lack a sense of accomplishment, and become indifferent or alienated from their work due to long-term high workload. Numerous studies have pointed out that excessive work pressure increases the risk of mental health problems among counselors and reduces their work quality and efficiency. For example, counselors experiencing burnout may fail to empathize with students' psychological distress or provide sufficient patience.

### **3.3. Limited resource support**

Many vocational colleges invest insufficiently in mental health education resources, which restricts counselors' ability to carry out mental health work and its effectiveness. This is reflected in the following three aspects: firstly, Outdated equipment in counseling rooms: there is a general lack of psychological education equipment, such as psychological assessment tools, sandplay props, and relaxation training devices, which are crucial for conducting professional psychological assessments and interventions. Due to inadequate hardware investment and insufficient attention, many vocational colleges have not yet fully equipped these facilities. Secondly, Shortage of full-time psychology teachers: Vocational colleges tend to allocate more energy and resources to teaching and practical training, resulting in insufficient human resources invested in mental health education. Counselors, who are often not professionally trained in psychology, are frequently assigned additional counseling tasks. This "part-time" role not only increases counselors' workload but also hinders the development of mental health education. Lastly, Underutilization of relevant software: Mental health education software, such as online psychological assessment tools and mental health education software, can provide auxiliary support for counselors in their work. However, in reality, due to constraints such as technical conditions and financial resources, these software tools are not fully utilized.

## **4. Strategies for improving mental health education work of vocational college counselors**

In the new era, the scale of vocational college student groups is expanding day by day, with prominent characteristics such as diversification and individualization, which put forward higher requirements for school mental health education<sup>[6]</sup>. Counselors shoulder important responsibilities and missions in college students' mental health education, so it is necessary to adopt some strategies to improve the mental health education work



of vocational college counselors <sup>[7]</sup>.

#### **4.1. Strengthen professional training**

Strengthen training to improve the level of mental health education. To enhance the mental health education ability of vocational college counselors, vocational colleges should organize them to receive regular and systematic training, and also invite psychological experts to conduct relevant training. The training content should involve the differentiation and handling of psychological problems, such as training on common mental illnesses like depression, anxiety, and social phobia; improving vocational college counselors' communication skills, such as how to use non-violent communication to gain the trust of both counselors and students; and transforming positive psychology theories into practice, for example, using the three qualities of positive psychology, gratitude, optimism, and resilience, to cultivate students' psychological qualities.

In addition, schools can guide counselors to obtain psychological counselor certificates or other relevant certifications to enhance their professional capabilities. By earnestly participating in national psychological counselor examinations, counselors can not only acquire systematic theories but also accumulate practical skills, enabling them to exert their talents in the position of mental health education. Corresponding policies should be formulated for counselors, providing certain financial subsidies to reduce their pressure in taking psychological counselor examinations, etc.

#### **4.2. Provide auxiliary support**

In view of the heavy workload and huge psychological pressure faced by vocational college counselors, schools should provide them with a relatively stable working environment to alleviate their work pressure. For example, increasing investment in human resources to reduce counselors' workload, setting up an independent psychological counseling station, where full-time psychological teachers participate in handling major psychological problems with counselors. At the same time, an intelligent management system can be introduced to assist counselors in effectively completing some daily routine tasks, such as sorting out student information and activity information, so that counselors can have more energy and time to do a good job in mental health education.

Moreover, schools can establish a mutual assistance mechanism among counselors, realizing mutual assistance through irregular experience exchange meetings or group discussions. The mutual assistance network platform among counselors enables them to exchange experiences and methods, seek solutions on time when confused, and at the same time meet their sense of belonging and professional achievement, thereby reducing the occurrence of burnout.

#### **4.3. Expand practical resources**

At the same time, vocational colleges can use external resources to create richer practical conditions for counselors. For example, establishing cooperative relations with local mental education centers, allowing them to practice or visit, so as to enhance their mastery and understanding of psychological knowledge; or using technical means such as online platforms to realize sharing, communication, and discussion in the form of online learning and offline discussions, cultivating counselors' ability to receive new resources and methods promptly.

In addition, schools can develop and promote digital resources for mental health education, such as online psychological assessment systems and micro-courses on mental health education, to provide convenient support tools for counselors. These resources can not only help counselors complete mental health education work more

efficiently but also stimulate students' interest in participation and improve the overall effect of mental health education. Through the combination of internal and external resources, practical resources can be continuously enriched, and finally, the comprehensive improvement of vocational college counselors' mental health education work can be achieved.

## 5. Conclusions

In summary, the importance of mental health education work carried out by vocational college counselors cannot be ignored. Through the aforementioned research and practical exploration, the aim is to enhance the service capabilities of vocational college counselors in the field of college students' mental health, promote the improvement of the overall level of mental health education in vocational colleges, and thereby better maintain and enhance the mental health of college students<sup>[8]</sup>. As an important part of student management work in vocational colleges, mental health education is not only related to the all-around development of students but also directly affects the harmony and stability of the campus. However, at present, vocational college counselors still face many challenges in mental health education work, such as insufficient professional capabilities, excessive work pressure, and limited resource support. The existence of these problems reminds us that we must take practical and effective measures to improve counselors' level of mental health education<sup>[9]</sup>.

Positive psychology theory provides new ideas and directions for solving the above problems. By integrating the core concepts of positive psychology into the work practice of vocational college counselors, it can not only help counselors face challenges in their work with a more positive attitude but also effectively guide students to establish healthy ways of thinking and cultivate optimistic and resilient psychological qualities<sup>[10]</sup>. For example, by promoting specific practical methods such as gratitude education<sup>[11]</sup>, goal setting, and emotional management, students' psychological state can be significantly improved<sup>[12]</sup>. Their learning efficiency and quality of life can be enhanced.

In the future, it is hoped that more vocational colleges can fully recognize the importance of mental health education work and increase investment and support in this field<sup>[13]</sup>. At the same time, they should continuously explore and improve relevant mechanisms to form a scientific and standardized mental health education system, so as to better serve students' growth needs. Only when vocational college counselors have solid professional knowledge and good psychological qualities can they truly become guides on students' growth path, helping them move towards a healthier and happier life journey<sup>[14]</sup>. This is not only a focus on individual development but also a strong impetus for the healthy development of the entire vocational education cause. The team of vocational college counselors assumes a more important and special role. They need to stay true to their original aspirations, keep their mission in mind, maintain the advanced nature, sense of the times, and innovative power in ideology and politics, and provide strong guarantees and support for the mental health development of vocational college students<sup>[15]</sup>.

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# Research on the Application of AI-Assisted Teaching in New Primary English Textbooks

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**Abstract:** Nowadays, with the rapid development of science and technology, various AI technologies are emerging in our lives and work. In the field of education, these advanced technologies are like a “cardiotonic” injected into the development of modern education. This paper analyzes the characteristics of new primary English textbooks and the advantages of applying AI-assisted teaching in them, and makes a preliminary exploration of the application paths of AI-assisted teaching in new primary English textbooks from four aspects.

**Keywords:** AI-assisted teaching; Primary English; Textbook application

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## 1. Introduction

In the context of globalization, English is being used with increasing frequency and in a growing number of scenarios. Therefore, the importance of mastering English is self-evident. The period from 3 to 12 years old is the golden age for humans to learn a second language. Hence, teachers must help students lay a solid foundation in English during the primary school years to remove obstacles to their future development.

## 2. Analysis of the characteristics of new primary school English textbooks

### 2.1. Emphasizing practical English application with themes closely connected to daily life

Taking the new People’s Education Press (PEP) English textbook for Grade 4, Volume 1, as an example, the unit themes mainly focus on family, social interactions, and other aspects <sup>[1]</sup>. For instance, units like “Unit 1 My Classroom,” “Unit 3 My Friends,” and “Unit 6 Meet My Family!” not only enhance primary school students’ sense of social awareness and cultivate their initiative and enthusiasm to use both their mother tongue and spoken English, but also strengthen their sense of family responsibility. Through these themes, students come to understand that learning English is not only a responsible act towards themselves but also towards their families and society <sup>[2]</sup>. In short, unlike other non-linguistic subjects, English requires students to not only memorize words, grammar, and

phrases but also dare to “speak up.” The alignment between English textbook themes and children’s daily lives can, to a certain extent, encourage them to actively “speak English” frequently and repeatedly.

## **2.2. Following the law of progressive learning to gradually increase grammar difficulty**

For primary school students, they can memorize content and master skills in a short time if they are interested in it. However, as a non-native language, English poses challenges in two aspects: on one hand, its pronunciation may cause discomfort to students, reducing their initiative to “speak English”; on the other hand, learning English involves long-term, complex, and arduous processes, which clearly conflict with primary school students’ psychological tendency of “curiosity and playfulness”<sup>[3]</sup>. As a result, most children exhibit significant “inertia” in learning English. The new English textbooks’ adherence to the law of progressive learning can largely alleviate this problem. It prompts teachers to adopt new teaching models, gradually help students accumulate grammatical knowledge, improve their proficiency in applying English grammar, and ultimately perfect their grammatical system.

## **3. Advantages of AI-assisted teaching in the application of new primary school English textbooks**

### **3.1. Realizing personalized learning**

The application of AI technology in primary school English classrooms, on the one hand, can collect basic data such as pupils’ learning habits and academic performance, and establish an intelligent analysis and tracking mechanism, thus providing a strong impetus for the improvement of students’ English ability. On the other hand, it can recommend content that conforms to children’s interests, hobbies, teaching progress, and difficulty level based on the basic data, to meet students’ personalized learning needs<sup>[4]</sup>. For example, AI-assisted teaching can recommend English content and exercises of appropriate difficulty according to pupils’ current academic performance and status, helping them gradually catch up with or even surpass the teaching progress and comprehensively improve their English proficiency. At the same time, the application of VR technology can also shorten the distance between students and the English subject, stimulate their potential enthusiasm for English learning, and improve their classroom participation<sup>[5]</sup>.

### **3.2. Accurate teaching evaluation and feedback**

AI-assisted teaching enables teachers to keep abreast of students’ learning situations, such as homework completion, classroom participation, and test scores, and provides a large amount of comprehensive data support for the adjustment of teaching progress and teaching strategies, ensuring that the adjusted teaching progress and strategies can have a positive impact on students’ English ability. Meanwhile, such flexible adjustments and real-time AI monitoring can also help children understand their own strengths and weaknesses, guiding them to make up for gaps, avoid arrogance and impetuosity<sup>[6]</sup>.

AI intelligent systems can continuously record and analyze students’ learning process in the whole process, realizing precise teaching evaluation. By tracking students’ learning progress and effectiveness in real time, AI can timely identify problems encountered by students in learning and provide targeted tutoring suggestions and personalized learning plans. At the same time, AI can also provide teachers with detailed and timely teaching feedback, assisting teachers in dynamically adjusting teaching strategies and progress, and optimizing teaching methods.



### 3.3. Optimizing classroom teaching scenarios

The mastery of language skills is inseparable from participation in “speaking” and corresponding language scenarios<sup>[7]</sup>. However, in traditional primary school English classrooms, teachers often rely on textbooks and let students try to complete oral training based on the scenarios in the textbooks. Although this method can improve students’ oral English ability, it cannot help medium and low-achieving students with average ability and a weak foundation to quickly improve their English proficiency. The combination of AI-assisted teaching and VR equipment can bring students into real situations, allowing them to infer, feel and understand English speaking, grammar, and phrases based on their mother tongue ability, thus fundamentally improving their English ability<sup>[8]</sup>.

At the same time, the integration of AI technology can also enhance the interactivity and interestingness of teachers’ teaching, improve students’ initiative and enthusiasm in participating in activities, and enable students to naturally master English knowledge in “real” interactions and games that combine education with entertainment.

## 4. Effective strategies for applying AI-assisted teaching in new primary school English textbooks

### 4.1. Utilizing AI-assisted teaching to implement personalized instruction

The integration of AI-assisted teaching and educational systems provides a strong impetus for reforming primary school English teaching, with particularly prominent advantages in facilitating students’ personalized ability development. By leveraging AI-assisted teaching, teachers can design and innovate more methods and activities characterized by “teaching students in accordance with their aptitude,” thereby enhancing students’ learning experience and improving teaching quality. Meanwhile, the integration of AI-assisted teaching and big data technology enables rapid collection and classification of students’ English foundational data, accurately identifying individual learning difficulties among primary school students. For example, in Unit 5 My Clothes of the Grade 4 English textbook (People’s Education Press), the key teaching difficulty is helping students correctly use possessive nouns. AI-assisted teaching can pinpoint individual students’ difficulties in this unit through online quizzes and adopt scientific methods to help them overcome these challenges. For instance, if AI detects that Student A confuses plural nouns with possessive forms, it will design comparative fill-in-the-blank exercises such as:

These are \_\_\_\_\_ (Tom) shoes.

The \_\_\_\_\_ (children) toys are in the box.

If AI identifies that Student B struggles with distinguishing the pronunciation of singular and plural possessives, it will create listening exercises like comparing “The dog’s tail is long.” and “The dogs’ tails are long.” to help address pronunciation issues. Personalized instruction through such methods effectively achieves a win-win situation for both “teaching” and “learning.”

### 4.2. Utilizing AI-assisted teaching to flexibly adjust progress

English is a “global” language through which students can communicate with children from different countries. However, the meaning of vocabulary can vary with different pronunciations. For example, the word “spring” is pronounced /sprɪŋ/ in standard English, meaning “spring.” But if children place the stress further back when pronouncing it, it may refer to “spring” (as in “Check the spring”). This highlights the importance of improving pronunciation skills for primary school students<sup>[9]</sup>. In traditional pronunciation teaching, teachers often lack real-time feedback tools, making it difficult to accommodate differences in individual learning rhythms. This leads to situations where students with weaker foundations “cannot keep up” and those with stronger abilities “are not

sufficiently challenged,” which in turn affects the friendly development of teacher-student relationships. In the AI-assisted teaching model, teachers can encourage students to download excellent AI agents, leveraging their functions such as speech recognition, speech-to-text conversion, language communication, and difficulty adjustment. This not only stimulates students’ enthusiasm to actively practice pronunciation and “speak up”<sup>[10]</sup> but also helps teachers flexibly adjust teaching progress. For example, Unit 1 Making Friends in the Grade 3 English textbook (People’s Education Press) involves numerous dialogues about self-introduction and introducing friends to others. When teaching this unit, teachers can have students practice their oral pronunciation by communicating with AI agents. Students can activate the AI agent’s voice dialogue function and introduce themselves as if chatting with a real friend: “Hello! My name is Lucy. I’m nine years old. I like drawing and singing.” The AI agent will not only respond in real time but also provide feedback on pronunciation issues, such as: “Lucy, the pronunciation of ‘aw’ in ‘drawing’ can be fuller.” It will also demonstrate the standard pronunciation for the student. When introducing friends to the AI agent, if a student says, “She has long hair and big eyes. She is very kind,” and makes pronunciation errors, the AI agent can mark the mispronounced words using bilingual prompts or speech-to-text functions. As students gradually “keep up” and “get enough challenges,” teachers can decide whether to proceed to the next stage of pronunciation teaching based on the real-time feedback data from the AI agent<sup>[11]</sup>.

### **4.3. Utilizing AI to assist teaching and conduct online instruction**

The application of AI-assisted teaching in new primary school English textbooks can not only optimize classroom teaching scenarios and methods, but also improve the quality and effectiveness of online teaching, and enhance students’ confidence in learning English. Through AI-assisted teaching, teachers can construct multi-dimensional, dynamic, and real language application scenarios based on students’ real-time learning status and feelings<sup>[12]</sup>.

For example, when teaching “Unit 6 Meet my family!” in Grade 4 of the People’s Education Edition during online classes, teachers can use AI + VR technology to bring students into a virtual “family” environment. With VR devices, students can be immersed in a lively family scene and complete the task of “making weekend plans” in English, such as telling interesting school stories to the AI virtual “mother” or asking the “father” about recent family travel plans in English. This immersive scenario can effectively enhance children’s sense of accomplishment and confidence, arouse their intrinsic learning motivation, and promote the development of a positive and healthy learning attitude<sup>[13]</sup>.

In addition, the integration of AI technology and online teaching can further improve the pertinence and personalization of online teaching resources. For instance, based on students’ weak points, appropriate English exercises and learning resources can be recommended to them. After teaching “Unit 3 My weekend plan” in the first volume of Grade 6 English of the People’s Education Edition, teachers can use AI software to select suitable learning resources and practice exercises for students, upload them to the online learning platform, and push vivid micro-course videos to students. These videos, through animated character dialogues, help students consolidate the knowledge learned in class.

### **4.4. Utilizing AI to assist teaching and enrich evaluation forms**

As an important part of teaching, diversified evaluation forms can help students better understand their strengths and weaknesses, thereby adjusting their study plans and methods<sup>[14]</sup>. In addition to evaluating students on online platforms, AI technology can also realize peer evaluation among students. The process is as follows: First, assign peer evaluation tasks. Teachers can use AI software to select appropriate evaluation tasks for students and clarify the evaluation content and standards; Second, submit learning tasks. Students can record “oral assignments” or

write written assignments by themselves and upload them to the learning platform equipped with AI tools; Third, distribute peer evaluation tasks. The AI learning platform assigns corresponding peer evaluation tasks according to students' strengths or abilities; Fourth, receive tasks and conduct discussions. Students score based on their personal experience, and note the reasons for errors as well as methods and skills to avoid them; Fifth, summarize peer evaluation results. AI can automatically collect and sort out students' evaluation results, and classify the results according to problems, facilitating teachers' guidance and explanation. The "AI + peer evaluation" model can have a positive impact on students from multiple dimensions, such as improving English ability and critical thinking. For teachers, it can effectively ensure the quality and effect of teaching and further accelerate the process of the new curriculum reform<sup>[15]</sup>.

In addition, AI-assisted teaching can also continuously record and analyze students' entire learning process and conduct precise assessments. By monitoring students' learning progress and effectiveness in real time, AI can promptly identify problems in students' knowledge mastery and skill application. For example, by analyzing students' homework and test data, it can accurately locate individual students' confusion about the singular and plural forms of "possessive nouns". In response to these problems, AI can provide students with targeted tutoring methods such as pushing special exercises and recommending relevant micro-course videos. At the same time, AI can also provide teachers with detailed teaching feedback, such as the overall weak knowledge points of the class and the effect comparison of different teaching methods, thereby prompting teachers to adjust teaching strategies and methods on time, realizing the dynamics and flexibility of the teaching process, and effectively ensuring teaching quality.

## 5. Conclusion

In summary, the continuous advancement of artificial intelligence (AI) technology has brought brand-new opportunities and challenges to the development of primary school English teaching. On one hand, AI-assisted teaching can provide convenience for English teachers, break the constraints of traditional classroom models, and improve teaching quality. On the other hand, it can also help students expand their knowledge, stimulate their interest in English learning, and enhance their cross-cultural communication skills. However, artificial intelligence can never completely replace the role and status of teachers. Therefore, teachers must face up to AI-assisted teaching, so as to create a more high-quality English teaching environment, gradually solve the practical problems in "teaching" and "learning" in primary school English teaching, and contribute to the construction of efficient primary school English classrooms.

## Disclosure statement

The author declares no conflict of interest.

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# Innovation in AI-Enabled Interdisciplinary Teaching Modes and Effect Evaluation

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**Abstract:** Artificial intelligence (AI) technology is profoundly enabling the innovation of interdisciplinary teaching modes through such dimensions as reconstructing knowledge connection paths, optimizing teaching scenario design, and innovating evaluation systems. Based on typical cases at home and abroad, and combining the characteristics of AI technology with educational theories, this study proposes a four-dimensional innovation model of “dynamic generation of knowledge graphs - integration of virtual and real scenarios - adaptation of personalized learning paths - multimodal evaluation and feedback”.

**Keywords:** Artificial intelligence; Interdisciplinary teaching; Mode innovation

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## 1. Introduction

In recent years, with the rapid development of artificial intelligence (AI) technology, it has profoundly changed the way of education. General Secretary Xi Jinping demanded at the National Education Conference that “we should attach great importance to the challenges brought by AI to education, actively explore the integrated development of AI and education, and promote educational reform and innovation.” In terms of interdisciplinary learning, AI technology has subversive value. Interdisciplinary learning has characteristics such as difficult-to-break disciplinary barriers caused by the fragmentation of disciplines, low efficiency of intelligent dynamic integration, and insufficient targeted guidance. AI technology can promote the development of interdisciplinary learning from aspects such as intelligent knowledge graphs and the deep integration of virtual and real intelligent scenarios.

## 2. Model innovation of interdisciplinary teaching empowered by artificial intelligence

### 2.1. Dynamic integration model driven by knowledge graph

#### 2.1.1. Intelligent knowledge connection

The semantic association capability of artificial intelligence enables infinite possibilities for semantic relevance.



With the help of artificial intelligence, we can introduce the imaging principle of CT in medical science to students based on the wave-particle duality in quantum mechanics. This allows students to achieve interdisciplinary leaps and connections in knowledge with AI assistance, which can be called a “knowledge point springboard,” fostering the expansion of students’ horizons as well as their initiative, interest, and curiosity in learning. AI will automatically adjust the jumps in the knowledge graph in real time according to students’ learning progress and interest levels, enabling a personalized “learning through play” experience within the graph <sup>[1]</sup>.

### **2.1.2. Supporting cases**

The course “Biosensing Technology” at Nanjing University of Science and Technology has also attempted to use AI to construct a disciplinary knowledge system graph, which automatically summarizes the core knowledge points and theories in the course’s knowledge structure. Combined with the requirements of different experiments, AI can design optimal combinations of experimental materials based on relevant theories. With this technology, students can quickly find the nodes connecting different parts of the knowledge structure during the process of building it, at a speed far exceeding that of doing it on their own. This implementation also shows that AI greatly promotes the interweaving and reorganization of knowledge across different fields, and can provide references and inspirations for the reconstruction of interdisciplinary knowledge in other disciplines.

Maastricht University in the Netherlands used an AI-based audit assistance tool called Mind Bridge AI Auditor in its auditing course, simulating an interdisciplinary learning scenario combining accounting and computer science. Students were divided into groups of four, and actual transaction data from a listed company was selected as the experimental dataset. The students were required to input the transaction data into the AI system and complete three main steps: first, using AI machine learning technology to analyze the heterogeneous data in this large-volume transaction and generate a heat map of risk occurrence rates; second, manually conducting risk analysis and designing audit procedures for transactions with high risk occurrence rates to identify transaction fraud patterns; third, adjusting the weight settings of various variables in the machine learning risk model, and reflecting on how different audit procedures affect the analysis results and how to reduce audit risks. This requires students to not only understand the academic principles of audit rules but also have a deeper understanding of the design and implementation of machine learning technologies, such as feature engineering and anomaly detection algorithms in machine learning. Moreover, through the comparison results of 127 groups of experiments, it was found that compared with traditional teaching methods, the accuracy of results (such as identifying the probability of transaction fraud) presented by the AI-assisted algorithmic auditing method increased by 14%, and students independently designed a hybrid auditing model that combines business rules with transaction data characteristics.

## **2.2. Context construction model of virtual-real integration**

With the emergence of VR/AR technology as a branch of artificial intelligence, we are endowed with the means to enable interdisciplinary teaching with panoramic and immersive experiences. For example, in the scene experience of ancient Egyptians building dams, students can put on VR glasses to enter a panoramic immersive teaching environment and see how ancient Egyptians used their wisdom to build dams and carry out irrigation. In the simulated environment of teaching software, through operation, students can truly see how ancient Egyptians built dams, understand the structure of dams, and at the same time, combine practical operations to observe how ancient Egyptians actually carried out irrigation. Through practical operations, they can judge what conditions they need to improve irrigation efficiency. At the same time, the actual behavior data of students’ operations and

the behavior data during the learning process are statistically analyzed and summarized by intelligent algorithms. Thus, students' cognitive difficulties and interest can be known. According to students' needs, the algorithm then upgrades their abilities to help them break through cognitive difficulties and develop the transfer ability and innovation ability of interdisciplinary learning<sup>[2]</sup>.

### **2.3. Data-driven personalized learning paths**

Intelligent learning oriented to students' learning situation uses AI technology to establish a personalized learning partner relationship of cognitive insight, accurate diagnosis, and intelligent guidance through big data analysis and machine learning models. It collects and analyzes data on knowledge mastery, cognitive development, and learning behavior habits from multiple dimensions, establishes learning portraits based on knowledge graph data, and adaptively establishes personalized learning paths for students with thousands of faces through feature aggregation and association rule mining of machine learning. It establishes intelligent learning resource matching, learning rhythm control, and the key in the process is to find the most effective learning path. In terms of technical implementation, the knowledge space model is used to determine the zone of proximal development for learning, the Bayesian knowledge tracing to predict the learning state, and the multi-armed bandit model to optimize the learning path, specifically the personalized learning path composed of knowledge sequence, resource type, interaction mode, etc.<sup>[3]</sup>

For example, adaptive learning uses big data and machine learning algorithms to analyze students' learning behavior data, including learning time, accuracy of answering questions, learning progress, etc., to deeply understand each student's learning characteristics and needs. Integrating adaptive learning into the classroom is highly targeted and follows the principle of adapting to students' needs. Taking a primary school classroom in Suzhou, Jiangsu Province as an example, AI digital humans are used as teachers in the classroom. They not only dynamically adjust the teaching rhythm by feeding back students' pronunciation accuracy and grammar application level, but also appropriately adjust the learning rhythm in real-time according to students' learning situation and preferences. For instance, in a class, the AI digital human teacher finds that individual students have a high accuracy in pronouncing words when reading English, but their pronunciation of some letters is still not accurate enough. Immediately, the digital human teacher identifies the accurate pronunciation of these letters, and students correct their pronunciation by following the reading. The digital human teacher also matches animation effects on the screen to help students solve pronunciation problems as soon as possible in an interesting way. The application of artificial intelligence in teachers' "teaching" and students' "learning" allows students to learn according to their own level, and reasonably sets the learning progress in the dynamic evaluation of "teaching" and "learning," so that each student can receive the most suitable teaching content and rhythm, and feel their own learning progress and rhythm. This is the real "thousands of people, thousands of faces." This new learning method greatly stimulates students' interest and improves their efficiency, and also has certain reference significance for other aspects of students' learning<sup>[4]</sup>.

### **2.4. Multimodal evaluation and feedback system**

#### **2.4.1. Innovation heat map**

Shandong University of Art & Design has introduced an AI evaluation system, which can not only comprehensively assess students' interdisciplinary works from 12 dimensions, including aesthetics, technical rationality, and creativity, but also automatically generate an intuitive and visualized innovation heat map through AI algorithms. Different colors and lightness indicate the level distribution of students in each dimension,

enabling teachers to intuitively perceive students' innovation ability and strong fields. In addition, the AI system can also provide students with targeted suggestions for improvement, point out the directions they can work on, and stimulate their motivation for continuous creation. The application of the innovation evaluation system provides new tools and methods for interdisciplinary teaching evaluation <sup>[5]</sup>.

#### **2.4.2. Ethical annotation mechanism**

Second, in terms of the ethical annotation mechanism, as AI technology is increasingly applied in interdisciplinary teaching, it is urgent to implement an ethical annotation mechanism in terms of academic integrity and originality of works. For example, the EU stipulates that work with more than 50% AI intervention must be marked with "technology-assisted". On the one hand, this can alert evaluators and readers to pay attention to the creation process of works, thereby forming academic recognition and respect for AI-assisted creative works; on the other hand, it can also help us more clearly indicate the participation and proportion of humans in creation, making AI-assisted creation more conducive to interdisciplinary teaching and the development of AI technology.

### **3. A multi-dimensional evaluation system for the empowering effects of artificial intelligence**

#### **3.1. Improvement in academic performance**

In higher vocational education and undergraduate education, artificial intelligence (AI) technology enables precise diagnosis of learning needs and personalized teaching, thereby enhancing students' professional practical abilities and capabilities in solving complex problems. For example, the School of Electronic Information and Artificial Intelligence at Shaanxi University of Science and Technology has explored educational innovation by integrating AI technology. In their research on the "AI-empowered hybrid teaching model combining theoretical and experimental tracks (online and offline)," AI teaching assistants construct intelligent training modules for integrated circuit design, AI algorithms, and other subjects through knowledge graphs. By collecting real-time process data such as students' programming, debugging and experimental operations, it was found that compared with traditional teaching models, the code error rate of vocational students in embedded system development decreased, and the completion rate of projects improved <sup>[6]</sup>.

#### **3.2. Innovation capability and critical thinking**

Beyond STEM literacy, the effective integration of AI technology also positively promotes students' creativity and critical thinking. Studies have shown that AI integration enhances students' innovative and creative abilities <sup>[7]</sup>. Specifically, ANOVA tests indicate that after AI integration, students completing interdisciplinary tasks demonstrated approximately a 27% improvement in creative performance, with a statistically significant difference ( $p < 0.05$ ). This is mainly because AI integration significantly increases students' vicarious experiences—such as virtual science, virtual laboratories, and virtual environments—providing them with more experiences to foster innovation and creativity.

Furthermore, AI as a source of vicarious experience effectively enhances students' confidence in creation. Regression analysis reveals a significant positive correlation between AI-based vicarious experiences and students' creative confidence ( $\beta = 0.37$ ), meaning more vicarious experiences provided by AI correspond to higher creative confidence. This is a fundamental attitude and ability for students' future interdisciplinary exploration and innovation.

### 3.3. Development of interdisciplinary literacy

AI technology, in conjunction with UNESCO's 5C model (critical thinking, creativity, communication, collaboration, and culture preservation), strongly supports the development of interdisciplinary literacy. In other words, through intelligent learning resources and interactive platforms, AI promotes the development of students' interdisciplinary competencies, including critical thinking, creativity, communication, collaboration, and cultural preservation<sup>[8]</sup>.

- (1) Critical Thinking: AI can automatically provide learning materials and questions tailored to students' cognitive abilities and learning progress, encouraging them to engage in independent analysis and reasoning. Additionally, AI offers one-on-one feedback, fostering rational and independent thinking.
- (2) Creativity: AI not only provides students with a wealth of innovative ideas (e.g., AI-generated design schemes, simulated experimental data) but also offers new creative insights and optimizes ideas through data analysis. This intelligent support significantly boosts students' enthusiasm for innovation and the quality of their ideas<sup>[9]</sup>.
- (3) Communication: Through speech recognition and natural language processing, AI enables smooth human-machine dialogue. Students can express their viewpoints and ideas to AI, receive instant responses and suggestions, and this intelligent interaction enhances their communication skills while promoting deeper integration between students and AI in the learning process.
- (4) Collaboration: AI introduces new forms of cooperation, such as virtual teams and online collaboration, providing students with opportunities for cross-temporal and cross-spatial collaborative learning. In collaborative tasks, students work with peers from diverse backgrounds to solve problems, create value, and integrate resources. This intelligent collaboration generates an invisible momentum that draws students into interactive engagement, fostering teamwork skills, interdisciplinary knowledge exchange, and innovation<sup>[10]</sup>.
- (5) Cultural Preservation: AI converts traditional cultural resources into accessible, transmissible forms through digitization and virtualization. Students can learn about traditional culture, appreciate traditional art, and participate in cultural activities via AI, deepening their understanding and identification with heritage. This intelligent expansion strengthens the inheritance of traditional culture.

### 3.4. Optimization of teaching efficiency

Fourth, teachers' digital literacy influences teaching efficiency: the higher their digital literacy, the better they can leverage AI to optimize lesson planning and execute teaching tasks in the classroom<sup>[11]</sup>. On one hand, teachers with strong digital literacy can flexibly apply AI to design targeted, effective teaching activities based on actual needs and students' learning status. On the other hand, they can fully utilize AI's real-time feedback and big data analysis functions to accurately assess student performance, provide personalized support, and ultimately improve teaching quality and efficiency.

## 4. Challenges and countermeasures: Balancing technological empowerment and educational essence

### 4.1. Degree of academic performance improvement

#### 4.1.1. Risk characteristics

After interdisciplinary teaching adopts standardized templates, teaching efficiency has been improved, but it will



also lead to homogeneity in students' homework. In the process of students' creation, the teaching content and learning suggestions output by AI, together with the mode of cooperation with AI, follow templates and program algorithms. This mode is convenient but will invisibly restrict students' creativity and uniqueness. In the long run, it is easy to form students' thinking stereotypes. Maintaining innovation and uniqueness may make students lose the ability to solve problems independently.

#### **4.1.2. Coping strategies**

To prevent students' works from being identical when using AI for creation, teachers should guide students to use AI technology correctly while leaving a certain original space and encouraging diversity. They can design some open-ended questions and provide different learning materials to promote students' creative divergence and personalized performance. The AI system itself should also constantly improve its algorithms, reduce the set templates for students, and provide more diversified suggestions and feedback.

### **4.2. Dilemma in the transformation of teachers' roles**

When facing difficulties in promoting the transformation of teachers' roles, schools and teachers themselves need to actively respond. Schools should regularly hold teacher training courses, workshops, etc., to help teachers transform from traditional "knowledge lecturers" to "AI collaborators." The training content should not only include common sense and application of AI technology, but also discuss how to use AI technology to carry out innovative practical activities in interdisciplinary education.

The transformation should not stay at the verbal level. As teachers, they should take the initiative to accept this transformation, earnestly learn and understand knowledge about artificial intelligence technology and interdisciplinary teaching. Based on Venkatesh's Technology Acceptance Model, they can improve their ability to operate intelligent tools and their interdisciplinary learning and development capabilities from multiple perspectives, such as perceived usefulness, perceived ease of use, and social influence. They should take the initiative to accept new teaching methods and technologies, reflect on and adjust their teaching behaviors to adapt to the needs of the times <sup>[12]</sup>.

Schools and teachers also need to carry out cooperation and exchanges to jointly explore the optimal application scheme of AI technology in interdisciplinary learning. For example, organize interdisciplinary teaching forums, gather teachers from different disciplines to share their teaching experience and insights in interdisciplinary learning, and promote the exchange and collision of knowledge between different disciplines; establish an AI education and teaching case database, collect some successful AI education and teaching cases, and share them with other teachers.

Through the above attempts, it is believed that teachers can successfully overcome the hurdle of role transformation, complete the transformation to the role of collaborative designers of AI technology and disciplines, and contribute to the all-around development and cultivation of students' innovative ability.

### **4.3. Resource integration and policy coordination**

Integrate resources and coordinate policies to create a good educational ecology. First, explore and develop a series of innovative and practical interdisciplinary courses like "AI + X" as done by the High School Affiliated to Renmin University of China. This aims to solve problems such as students' excessive "verticalization" in knowledge fields, rigid vision, and diminished learning interest, to promote students to understand and experience AI through the integration and intersection of various disciplines, and on this basis, stimulate



students' exploration of the internal connections between different fields. Second, strengthen in-depth industry-university-research cooperation with enterprises, introduce the latest AI and application scenarios, and connect the theoretical and practical aspects of courses<sup>[13]</sup>.

The "education consortium" model is also a way to achieve in-depth coupling of school-enterprise resources. For example, organizing various organizational structures such as schools, enterprises, and research institutions to establish education consortia can, on the one hand, share resources, carry out collaborative innovation, and jointly explore the development of AI technology in interdisciplinary teaching practice models; on the other hand, promote close links between industry, university, research, and application, providing strong support for cultivating innovative and practical talents.

In the process of resource integration and policy coordination, the following two points should also be noted: first, pay attention to the effective integration and reasonable adaptation of resources to prevent redundant construction and resource waste; second, strengthen policy guidance and support to provide relatively perfect institutional guarantees and policy support for the development of interdisciplinary teaching under AI technology; third, innovate the evaluation system, establish an evaluation system that can comprehensively reflect learners' interdisciplinary learning and the improvement of interdisciplinary learning ability, and support learners to actively participate in interdisciplinary learning and practical actions, to promote the in-depth development of learners' interdisciplinary learning<sup>[14,15]</sup>.

## 5. Conclusion

In conclusion, the introduction of new forms of AI in interdisciplinary teaching has brought about a new transformation in teaching forms and a new multi-dimensional evaluation system, bringing new developments to students' learning, innovation, and evaluation, enabling students' interdisciplinary literacy to be fully developed and improved, and playing a role in teaching optimization. However, we must also face up to the problem of balancing technological empowerment and educational essence in the era of artificial intelligence, and build a three-dimensional educational ecology.

## Disclosure statement

The author declares no conflict of interest.

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# Dilemma and Countermeasures of E-commerce Talent Cultivation in the Era of Big Data

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**Abstract:** Against the backdrop of the vigorous development of big data technology, the e-commerce industry is facing new opportunities and challenges, with an increasing demand for professionals that is becoming higher and more complex. This paper deeply analyzes the dilemmas in e-commerce talent cultivation in the era of big data, including the disconnection between curriculum systems and the development of big data, insufficient big data literacy of teachers, weak integration of practical teaching with big data applications, and the lack of a big data-oriented evaluation system. To address these issues, countermeasures such as optimizing curriculum systems, strengthening teacher team building, deepening reform of practical teaching, and improving evaluation systems are proposed. The aim is to cultivate high-quality e-commerce talents who meet the needs of the big data era and promote the sustainable and healthy development of the e-commerce industry.

**Keywords:** Era of big data; E-commerce; Talent cultivation; Dilemma; Countermeasures

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## 1. Introduction

With the continuous development and widespread application of modern technological means such as artificial intelligence, big data, and cloud computing, people have now entered the era of big data, which is characterized by distinct digitalization<sup>[1]</sup>. E-commerce, as a major emerging product of the current development of the digital economy, has significantly raised its requirements for the abilities and qualities of talents. Under this situation, an increasing number of universities have begun to explore new paths for cultivating e-commerce talents, aiming to better respond to the various changes brought about by the development of the big data society. Therefore, this paper mainly conducts relevant analysis and research on the dilemmas and countermeasures in the cultivation of e-commerce talents in the era of big data, for reference only.

## 2. Dilemmas faced in the cultivation of e-commerce talents in the era of big data

### 2.1. Disconnection between curriculum systems and big data development

For e-commerce majors, their acquisition and mastery of curriculum knowledge, professional skills, and

vocational literacy largely depend on the curriculum systems designed by schools <sup>[2]</sup>. The design of such systems is closely linked to the actual needs of enterprise job positions. However, in the context of the big data era, many colleges and universities currently have e-commerce curriculum systems that are disconnected from the development of big data. These systems fail to fully consider the trends of big data development and actual job requirements, with their focus still primarily on early-stage courses such as commodity marketing, online marketing, and website construction and maintenance. They lack the integration of knowledge and skills related to big data and artificial intelligence <sup>[3]</sup>. Obviously, such curriculum designs can hardly ensure that students meet the development needs of the current society.

## **2.2. Insufficient big data literacy among faculty**

Currently, big data technology has demonstrated significant value in many fields such as education, healthcare, and e-commerce, with its applications becoming increasingly widespread <sup>[4]</sup>. Nevertheless, although many e-commerce teachers in colleges and universities possess solid theoretical foundations and rich professional teaching abilities, their big data literacy and digital teaching capabilities are relatively low. They cannot skillfully apply various data analysis software or visual teaching aids in their teaching, let alone comprehensively impart knowledge and skills related to big data and artificial intelligence to students. This, to a certain extent, affects students' learning and future development.

## **2.3. Weak integration of practical teaching with big data applications**

Nowadays, industries have increasingly high requirements for the abilities and literacy of e-commerce talents. As a crucial link to test students' learning outcomes and evaluate the quality of talent cultivation in schools, practical teaching has become more and more important. However, in the era of big data, some colleges and universities face the problem of weak integration between practical teaching and big data applications in e-commerce talent cultivation <sup>[5]</sup>. Specifically, there are two main reasons for this issue: First, teachers do not attach enough importance to practical teaching, some overly focus on explaining theoretical knowledge, while others fail to integrate big data-related skill training, making it difficult for students to flexibly address and solve various practical problems in the workplace. Second, schools' big data experimental equipment needs improvement, and they cannot provide students with big data training platforms for practical exercises, which further leads to the weak integration of practical teaching with big data applications.

## **2.4. Lack of a big data-oriented evaluation system**

Teaching evaluation is an important part of talent cultivation, as it can effectively assess students' mastery and application of knowledge, teachers' teaching levels, and the comprehensive strength of schools <sup>[6]</sup>. Moreover, through scientific and effective teaching evaluation, teachers can more timely and comprehensively identify problems in teaching, and then use this as a basis to improve and optimize talent cultivation plans and curriculum teaching strategies. However, in the era of big data, the evaluation systems for e-commerce talent cultivation in colleges and universities lack a big data orientation. Most evaluations focus on students' abilities and fail to fully consider the impact of big data applications on students' learning and development, nor have they established scientific evaluation indicators for big data application capabilities. This easily leads to students paying insufficient attention to big data applications, making it difficult for them to adapt to the requirements of the big data era and industrial development.

### **3. Optimization strategies for e-commerce talent cultivation in the era of big data**

#### **3.1. Optimizing the curriculum system**

In view of the problem that the current e-commerce talent cultivation curriculum system is disconnected from the development of big data, colleges and universities should actively add some digital-related course contents and further optimize the curriculum system to better assist students' learning and development. Firstly, colleges and universities can, in combination with the actual needs of the digital transformation of the e-commerce industry in the context of the big data era, add a course on "Data Science and Big Data Analysis" and incorporate knowledge points such as data mining, data visualization, and statistical analysis into this course. This will guide students to master methods and skills in data collection, data processing, and data analysis, ensuring that they can effectively use such data to make scientific e-commerce decisions in future work and improve business efficiency and quality <sup>[7]</sup>. Secondly, colleges and universities can add a course on "Artificial Intelligence and Machine Learning", integrating knowledge and skills such as relevant basic theoretical algorithms, automated process design, model training techniques, and intelligent recommendation system construction into the course. This will enable students to fully recognize the great value of modern technical means in the development of the e-commerce industry and cultivate their ability to apply digital technologies. Finally, colleges and universities can also add courses on "Cloud Computing" and "Mobile Commerce" to the basic e-commerce curriculum system. These courses will teach students how to use cloud computing technologies and cloud platforms for e-commerce marketing services and operation management, thereby further enhancing their market competitiveness in the era of big data <sup>[8]</sup>.

In addition, to better ensure the practicality and effectiveness of the newly added course contents, colleges and universities need to establish active cooperative relationships with e-commerce enterprises. They can invite industry experts and front-line enterprise staff to the school to give knowledge lectures, participate in the optimization design of the curriculum system, and jointly develop teaching projects. This will allow students to access more cutting-edge industry technologies, enrich their practical experience, and ultimately lay a solid foundation for them to adapt to the requirements of the digital transformation of the e-commerce industry in the era of big data <sup>[9]</sup>.

#### **3.2. Strengthening the construction of teaching staff**

In the context of the big data era, if colleges and universities want to further improve the quality of e-commerce talent training, they must attach importance to the optimization and construction of the teaching staff, and continuously enhance teachers' professional level and ability literacy to ensure that they can provide better teaching services for students' learning and development.

First of all, colleges and universities should regularly organize teachers to participate in professional further education and skill training activities, such as professional seminars and training sessions in the e-commerce industry. This enables teachers to fully understand the latest developments and technological trends of the e-commerce industry in the big data era, such as big data analysis, digital marketing, artificial intelligence applications, and e-commerce platform operations <sup>[10]</sup>. At the same time, colleges and universities need to strengthen the training of teachers' digital teaching capabilities. For example, they can use big data technology to fully understand teachers' digital teaching levels, and on this basis, carry out hierarchical and diversified education and training, and build big data learning platforms for them, so as to continuously improve their digital literacy.

Secondly, colleges and universities need to strengthen school-enterprise cooperation, encourage teachers to



actively go deep into enterprises for professional practice and on-the-job training. This allows teachers to further master the actual operation processes of e-commerce, marketing strategies, and the application of advanced cutting-edge technologies in practical work, prompting them to transform these practical experiences into teaching resources, thereby better ensuring that the content taught by teachers is in line with reality<sup>[11]</sup>.

Finally, colleges and universities need to cultivate teachers' good international awareness, encourage them to actively participate in international e-commerce academic conferences or seminars, and engage in in-depth discussions with experts and scholars from other countries and regions, to continuously broaden their international perspective and academic vision. Doing so will be more conducive to colleges and universities cultivating e-commerce professionals with a certain international perspective.

### **3.3. Deepen the reform of practical teaching**

Practical teaching is an important way to help students further consolidate the theoretical knowledge they have learned. In the context of the big data era, colleges and universities should continue to deepen the reform of practical teaching to better promote students' learning and development.

First of all, colleges and universities can strengthen the organic integration of digital educational and teaching resources. For example, they can appropriately introduce advanced e-commerce simulation software, online teaching platforms, big data analysis tools, etc., according to their actual situation, to create a good digital practice environment for students<sup>[12]</sup>. In practical teaching, teachers can arrange for students to use these digital teaching devices to simulate real e-commerce operation processes, enabling them to deepen their professional knowledge of e-commerce and gradually master advanced technologies such as artificial intelligence, big data, and cloud computing in the process of practice<sup>[13]</sup>. In addition, teachers can organize students to participate in innovation competitions related to e-commerce and artificial intelligence, so as to cultivate students' ability to solve practical e-commerce problems by using artificial intelligence, big data, etc., such as the improvement of search algorithms and the optimal design of chatbots. In this way, students can also flexibly use digital technologies and tools to solve problems in future e-commerce operations, which is conducive to laying a solid foundation for their future career development.

Secondly, colleges and universities can rely on the integration of industry and education, deepen school-enterprise cooperation, and jointly build digital training bases for students with enterprises. In this way, enterprises can give full play to their educational advantages, provide students with more real business scenarios, data resources, and training project opportunities, so that they can gradually master how to use digital technologies to solve practical problems in enterprises<sup>[14]</sup>. In addition, colleges and universities can invite enterprise experts to jointly guide students' practice and provide students with VR/AR training equipment to ensure that students' practical training can always be in line with the development needs of the industry, thereby helping students further improve their employability.

Finally, based on the integration of industry, education, and research, colleges and universities can encourage professional course teachers, industry experts, and front-line enterprise staff to focus on important issues in the field of e-commerce, such as digital innovation, intelligent operation, and network security, to jointly develop digital training projects or research projects, and require students to actively participate, so as to provide them with more opportunities and platforms for practice and exercise.

### **3.4. Improve the evaluation system**

In the context of the big data era, the assessment and evaluation system for e-commerce talent training should

also keep pace with the times. In addition to the assessment of basic theoretical knowledge and professional abilities, attention should also be paid to examining students' technical application ability, innovative thinking, problem-solving ability, etc. <sup>[15]</sup> In practice, teachers can use online evaluation tools such as artificial intelligence or online testing platforms to scientifically evaluate students' learning and practical results, and use big data analysis technology to further analyze the scientificity of the evaluation results, to realize real-time dynamic monitoring and evaluation of students' learning process and learning results. In this process, teachers need to add evaluation criteria such as data analysis ability, artificial intelligence application ability, and the completion of e-commerce projects. At the same time, it is also necessary to introduce multiple subjects, such as enterprise mentors, industry experts, and students, for evaluation to ensure the comprehensiveness and effectiveness of the evaluation.

## 4. Conclusion

In summary, the advent of the big data era has exerted a significant impact on people's production and lifestyle. For practitioners in e-commerce-related fields, in addition to possessing rich professional theoretical knowledge and high professional practical capabilities, they must also have certain data mining and analysis abilities. Only in this way can they stand out in the current highly competitive market and even gain greater development space. Therefore, against the backdrop of the big data era, colleges and universities must strengthen the reform of e-commerce professional teaching and actively explore the teaching application of big data, to cultivate more high-skilled and high-quality interdisciplinary e-commerce professionals for the country and society.

## Disclosure statement

The author declares no conflict of interest.

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# Practice of Progressive Ideological and Political Reform in Experimental Courses under the Background of “New Engineering”: A Case Study of An Engineering Finite Element Course

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**Abstract:** Under the background of “comprehensive ideological and political education”, experimental teaching, as an important link connecting theory and practice in new engineering majors, plays an irreplaceable role in professional education and the construction of ideological and political elements in courses. Taking “Engineering Finite Element and Numerical Calculation,” a core course for undergraduates majoring in mechanical engineering, as an example, this paper focuses on the course training objectives and the fundamental task of fostering virtue through education. It organically integrates theoretical knowledge, practical engineering problems, cutting-edge technological development and ideological and political elements, and constructs a reform of the “learning-practice-research” progressive ideological and political teaching mode in experimental courses. The reform of the “combination of learning and thinking” experimental teaching mode integrates value guidance into knowledge imparting; the design of the “integration of practice and thinking” experimental links cultivates students’ engineering practice ability while enhancing their sense of engineering ethics and professional responsibility; the reform of the “integration of research and thinking” experimental content guides students to be brave in innovation and continuous exploration through scientific research project training. Through the analysis of the achievement degree of course and ideological and political objectives, as well as teaching evaluation, the effectiveness of the teaching reform is verified, which provides a referential implementation path and practical experience for the construction of ideological and political elements in “new engineering” experimental courses.

**Keywords:** Ideological and political elements in courses; Experimental teaching; Learning-practice-research; Engineering finite element

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## 1. Introduction

In 2020, the Guidelines for the Construction of Curriculum Ideology and Politics in Colleges and Universities issued by the Ministry of Education pointed out that “the construction of curriculum ideology and politics

is an important task for comprehensively improving the quality of talent training”<sup>[1]</sup>, and emphasized that engineering professional courses should focus on strengthening engineering ethics education, cultivating students’ craftsmanship spirit of excellence, and inspiring students’ feelings of family and country as well as sense of mission and responsibility to serve the country through science and technology<sup>[2]</sup>. In recent years, China has attached great importance to curriculum ideology and politics education, and has successively issued a series of policy documents to promote its implementation, while actively exploring its theoretical basis and practical paths<sup>[3]</sup>. Under the background of the “new engineering” reform<sup>[4]</sup>, experimental teaching, as an important means to cultivate students’ innovative spirit, practical ability and the integration of knowledge and practice, has become one of the key positions in the construction of curriculum ideology and politics<sup>[5]</sup>. East China University of Science and Technology, taking the “Electrical and Electronic” experimental course as an example, has carried out the reform of the “multi-line co-learning” curriculum ideology and politics model<sup>[6]</sup>. The course team of “Finite Element Method and Software Application” in Changzhou Institute of Technology has carried out the practice and teaching design of “three-module spiral progression” for curriculum ideology and politics education<sup>[7]</sup>; Tsinghua University, adhering to the educational concept of combining value shaping, ability training and knowledge imparting, has deeply integrated classroom teaching with innovative practice<sup>[8]</sup>. Chongqing University has deeply explored the connotation of curriculum ideology and politics, integrated the core socialist values, the ideal and responsibility of realizing the great rejuvenation of the Chinese nation with the content of the mechanical precision design experimental course, which has reference value for professional experimental courses<sup>[9]</sup>. Although the above-mentioned universities have achieved certain research results in the practice of curriculum ideology and politics construction, the current construction of experimental curriculum ideology and politics is still in the exploration stage, and a systematic and standardized teaching model and system have not yet been formed<sup>[10]</sup>. How to give full play to the characteristics of experimental teaching and realize the organic integration of professional education and ideological and political education has become an important research direction in the reform of ideological and political teaching in colleges and universities<sup>[11]</sup>.

In order to improve students’ internal motivation for learning while cultivating their solid engineering practice ability<sup>[12]</sup>, and to realize the role of ideological enlightenment and value guidance. Based on its own professional characteristics and disciplinary advantages, the Mechanical Engineering major of Xi’an Jiaotong University, relying on the experiments of the “Engineering Finite Element and Numerical Calculation” course, has deeply explored the ideological and political elements in experimental teaching, and explored the construction of a “learning-practice-research” progressive reform in experimental curriculum ideology and politics teaching. It organically combines professional practice with value shaping in a subtle way, providing ideas and implementation paths for the construction of experimental curriculum ideology and politics.

## **2. Experimental design of the “Learning-Practice-Research-Thinking” four-element integration course**

Against the backdrop of the rapid development of intelligent manufacturing, the engineering finite element method has emerged as a crucial tool for solving complex engineering problems<sup>[13]</sup>. Mastering finite element technology to design and develop mechanical products has become one of the core competency requirements for students majoring in mechanical engineering<sup>[14]</sup>. Currently, numerous domestic universities offer related courses in mechanical disciplines to meet the industry’s demand for high-quality engineering talent<sup>[15]</sup>. Xi’an Jiaotong University’s mechanical engineering program lists “Engineering Finite Elements and Numerical Computation” as



a core undergraduate course. Through its experimental component, the course guides students to apply theoretical knowledge to real-world engineering scenarios through project practice<sup>[16]</sup>, characterized by strong theoretical depth, high practical demands, and extensive engineering applications. The teaching team, aligning with the graduation requirements, course objectives, and disciplinary strengths of the mechanical engineering program, has deeply explored ideological and political elements in experimental teaching, integrating value cultivation with knowledge transmission. Drawing on Bloom's cognitive law—from learning to practice to innovation—they have designed and constructed a progressive “Learning-Practice-Research” ideological and political experimental teaching framework for the finite element course. This framework forms an experimental ideological and political teaching plan where theoretical learning serves as the foundation, engineering project practice as the core, and scientific research innovation as the culmination, with the three elements advancing in synergy.

The experiment comprises three main modules:

- (1) Integration of learning and thinking: Based on the finite element calculation formulas for rod and beam structures in theoretical courses, students conduct programming simulations using industrial finite element software. They learn the stories of scientists behind industrial software, discuss the “bottleneck” issues faced by domestic industrial software, and inspire a sense of mission to contribute to the country through technological innovation.
- (2) Integration of practice and thinking: Using engineering cases behind current political hotspots as entry points, students simulate the full process of designing and testing related mechanical products. This module closely integrates engineering design standards, a sense of responsibility, and experimental tasks.
- (3) Integration of research and thinking: Research projects from the academic team are transformed into undergraduate experimental content, and a comprehensive experimental platform with digital twin characteristics is developed. This guides students to combine cutting-edge technologies with experiments, encouraging them to innovate and explore continuously.

### **3. Practice of ideological and political integration in finite element experiment courses**

#### **3.1. Hybrid teaching mode of “Integration of Learning and Thinking”**

Relying on the online teaching platform, the teaching team has explored a hybrid experimental teaching mode of “integration of learning and thinking”. Before class, students can review the theoretical knowledge of finite elements, compare the development of Chinese and foreign industrial software, and learn about the scientific research stories of Chinese scholars behind the finite element theory through online platform resources such as video micro-lectures and teaching materials, thus establishing a perceptual understanding of the experimental course content and tools. During class, online resources such as electronic interactive textbooks, AI-assisted programming, and engineering case introductions assist students in conducting simulation analysis and experiments on classroom practice cases. After class, through the online platform's communication community and supplementary database, students can carry out extended exercises and innovative explorations. Meanwhile, the tracking and statistics of learning data on the online platform provide directions for the dynamic adjustment and continuous feedback of the course. Through the online-offline hybrid teaching mode, elements of ideological and political education are integrated into experimental teaching, giving full play to students' subjective initiative and achieving the student-centered education goal.

### **3.2. Design of project-based experimental links with “Integration of Practice and Thinking”**

The teaching team takes current political hot issues as the starting point, designs and develops several experimental cases transformed from real enterprise engineering projects, forming an experimental process of “current politics - problem - simulation - experiment - analysis”, which mainly includes:

- (1) Current politics introduction: Combining current political hotspots, while attracting students’ learning interest, relevant engineering analysis cases are introduced. Through case analysis, students understand the important role of finite element technology in engineering design, guides them to establish a sense of engineering responsibility and stimulates their feelings of serving the country through science and technology.
- (2) Problem orientation: Guide students to master the ability to analyze and describe engineering problems in accordance with relevant industry design specifications. At the same time, by introducing real projects of national independent brand product development, students’ national confidence is enhanced.
- (3) Modeling and simulation: Based on previous case studies and problem analysis, students conduct finite element modeling and simulation analysis of engineering projects to master the basic methods of finite element analysis and solution.
- (4) Experimental testing: Students conduct experimental tests on the platform and compare them with simulation data. To illustrate the mutual support between finite element simulation and experiments in engineering, the Apollo space accident case is introduced to enhance students’ sense of responsibility and standardize the experimental process.
- (5) Analysis and expression: Using enterprise analysis reports as templates, students are required to sort out experimental results and propose engineering design optimization schemes in line with national industry standards. Through the whole-process project practice, students’ awareness of engineering standards is improved, and their theoretical knowledge foundation and engineering practice ability are consolidated.

### **3.3. Reform of experimental content based on “Integration of Research and Thinking”**

The scientific research projects undertaken by the course team teachers have been transformed into high-level experimental content suitable for undergraduates. Several high-level innovative exploration projects with strong interest, advanced nature and challenging degrees have been designed, such as “Design of Origami Core Can and Its Impact on Carbon Emissions”, “Design of Lunar Soil Collection Manipulator Inspired by Tape Measures”, and “Stress Evaluation of Aeroengine Blades”. Students are required to form groups, choose their own topics, and use industrial software to conduct research. This allows students to truly apply their knowledge to innovative exploration in scientific research projects, helping them understand cutting-edge finite element technologies while inspiring their enthusiasm for innovation, exploration, and contributing to the country through science and technology.

## **4. Course evaluation and effectiveness**

The course adopts a diversified evaluation model including group competitions, classroom interactions, teacher evaluations, and peer evaluations to comprehensively assess experimental teaching and ideological and political education in the curriculum. According to the output-oriented calculation formula for course achievement indicators, the achievement of each ideological and political goal in the course has reached over 84% in the past

three years. The course has carried out three rounds of reform practices, with a total of 870 students participating. A survey on teaching effectiveness conducted through the online teaching platform shows that 99.7% of students believe the experimental sessions are of great help to theoretical learning and engineering application, and 89% of students think the introduced scientific research analysis projects have enhanced their interest in scientific research exploration.

## 5. Conclusion

As an important channel for applying theories to practical engineering, experimental teaching plays an increasingly significant role in the construction of “new engineering” and also serves as a key position for the ideological and political development in courses. The Mechanical Engineering program at Xi’an Jiaotong University has long adhered to the educational philosophy of “cultivating people with virtue”. It has deeply explored the ideological and political elements in experimental teaching and developed a progressive “learning-practice-research” educational scheme for ideological and political education in experimental courses. Taking the experiment of “Engineering Finite Element and Numerical Calculation” as an example, it has carried out teaching reform practices. Through the coordinated positioning of course objectives and ideological and political objectives, the integrated design of teaching links and ideological and political content, and the development of a digital twin comprehensive experimental platform based on scientific research transformation, it has organically integrated ideological and political education with practical teaching. From the perspective of teaching evaluation and feedback, the reform has achieved good results. The teaching design, methods, and models of ideological and political education in experimental courses, which integrate learning with thinking, practice with thinking, and research with thinking, provide a reference for the reform of ideological and political education in engineering practical courses.

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# Exploration of the Education and Teaching Mode for Professional Master's Students in Electronic Information

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**Abstract:** Postgraduate education is a higher-level stage in higher education. This paper discusses the problems and solutions in the education and teaching training of professional master's students in electronic information from the perspectives of the reform of the curriculum, ideological and political education mode, the exploration of training approaches balancing professional practice and scientific research, and the collaborative mechanism for the reconstruction of tutors' roles and improvement of their abilities.

**Keywords:** Postgraduate education; Curriculum, ideological and politics; Education and teaching reform

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## 1. Introduction

Postgraduate education represents a higher stage of higher education, bearing the important responsibility of cultivating high-quality, high-level creative talents for the country's modernization drive <sup>[1]</sup>. Under the new situation of continuous expansion in postgraduate enrollment, ensuring the quality of talent cultivation has become a core issue in the high-quality development of higher education.

Currently, various educational institutions are building a full-cycle quality assurance system <sup>[2]</sup>. On one hand, they strive to improve internal quality assurance mechanisms, forming a closed-loop management system through measures such as optimizing training program design, strengthening process-based assessment, and establishing dynamic systems for student selection and elimination <sup>[3]</sup>. On the other hand, they continue to enhance external supervision systems. In accordance with the requirements of the Overall Plan for Deepening the Reform of Educational Evaluation in the New Era, innovative regulatory measures are being implemented, including the promotion of double-blind review systems, strengthening the quality monitoring of dissertations, and establishing academic integrity archives <sup>[4]</sup>. This paper takes the construction of a postgraduate education quality assurance system in the context of the popularization of higher education as its research starting point, focusing on the field of postgraduate education in electronic information-related majors. By systematically analyzing the structural



contradictions and practical dilemmas in the current training system, it explores key issues such as the reform of the “curriculum-based ideological and political education” model, the exploration of training approaches balancing professional practice and scientific research, and the collaborative mechanism for the reconstruction and capacity improvement of supervisors. The aim is to provide theoretical references and practical paths for the cultivation of outstanding engineers in the new era.

## **2. Problems in the education and teaching of professional master’s students in electronic information-related majors**

### **2.1. Practical dilemmas in the collaborative education of “Ideological and Political Education in Courses” and “Ideological and Political Courses”**

Postgraduate education, as the core carrier of the national strategy for innovative talents, shoulders the era’s mission of cultivating virtuous and talented socialist builders and successors. Currently, the reform of ideological and political education in courses is faced with three practical dilemmas: Firstly, there is a structural contradiction between value guidance and knowledge imparting. Some teachers cannot transform political discourse into professional discourse, making it difficult to organically embed core socialist values into complex algorithmic deductions or engineering ethics analysis. Secondly, the mechanical superposition of ideological and political elements with course content leads to alienation phenomena such as “labeling” and “patchwork”. Thirdly, the imbalance between teaching logic and cognitive laws causes a breakdown in students’ acceptance chain of “value cognition-emotional identification-practical consciousness”. These problems not only weaken the teaching effectiveness of professional courses, but also may lead to the suspension risk of the collaborative education goal of “ideological and political education in courses” and “ideological and political courses”<sup>[5]</sup>. It is urgent to carry out systematic reforms from the dimensions of educational goal reconstruction and teaching design innovation.

### **2.2. Balancing professional practice and research achievements for professional master’s degree students**

Against the backdrop of the continuous expansion of postgraduate education in China, the scale of cultivation for engineering-oriented professional master’s degrees has shown a significant growth trend. Different from academic degrees, this professional category features a distinct engineering orientation, practical innovation, and technical application in its training positioning, and the reform of its training model has become a key issue in higher education. Taking the three-year training cycle as an example, the current training programs generally adopt a phased structure of “1 year of theoretical courses + 1 year of professional practice + 1 year of dissertation writing”. It is worth noting that although the National Engineering Professional Degree Graduate Education Steering Committee clearly requires that dissertation research should be organically integrated with professional practice, there are still significant deviations in specific implementation. This structural contradiction has led to two typical dilemmas: on the one hand, excessive emphasis on laboratory research weakens the cultivation of engineering practice capabilities; on the other hand, too much energy is invested in industrial practice, which squeezes the time for dissertation research, resulting in insufficient workload or lack of innovation in dissertations. Particularly noteworthy is that under the background of the “breaking the five-only” reform, some universities still maintain rigid requirements on postgraduates’ academic achievements. This institutional requirement, conflicting with the time allocation in the training process, has become a key constraint affecting the training quality of engineering master’s students. A direct reflection of this is that in recent years, the blind review

failure rate of engineering master's theses has been slightly higher than that of academic master's theses.

### **2.3. The construction of the supervisor team has a long way to go**

Postgraduate supervisors, as the primary responsible subjects for postgraduate training quality, have a decisive impact on the academic growth of postgraduates. With the acceleration of the popularization of higher education, the scale of the supervisor team has expanded significantly. There is a significant alienation tendency in the current supervisor selection mechanism: the selection criteria rely on explicit quantitative indicators such as research performance (e.g., output of SCI/SSCI papers, funds for vertical projects), while lacking systematic evaluation of qualitative factors such as teaching competence, effectiveness of teacher-student interaction, and developmental guidance for students <sup>[6]</sup>. There is a gap in guidance experience among new supervisors, and some supervisors have not yet completed the role transformation from researchers to educators, which is specifically manifested in shortcomings such as vague planning of training paths, fragmented process guidance, and lack of mechanisms for cultivating innovative capabilities.

A deeper institutional contradiction stems from the instrumental rationality orientation of the academic evaluation system. Under the current teacher title evaluation system, most domestic universities take research output as the core promotion indicator, leading to the phenomenon among supervisors of alienating postgraduate training into a tool for transforming research achievements. This guiding tendency is specifically characterized by: over-emphasizing the output of high-level papers while ignoring the construction of academic thinking; adopting a pressure-transmission management model, simply decomposing research KPIs to individual students, while paying little attention to students' career development needs and mental health status <sup>[7]</sup>. A small number of supervisors are deficient in cross-cultural communication skills and emotional support techniques, which may make it difficult to build a teacher-student academic community and may induce conflicts between supervisors and students.

## **3. Reform ideas for the education and teaching model of professional master's students in electronic information**

### **3.1. Reform of the curriculum ideological and political education model**

Under the background of higher education reform in the new era, the organic integration of professional courses and ideological and political education has become a key proposition for implementing the fundamental task of fostering virtue through education. A dynamic balance mechanism between professional knowledge and ideological and political content can be constructed from the following aspects:

#### **3.1.1. Reconstruction of educational goals**

With "fostering virtue through education" as the core, a dual-helix goal system of "professional ability + family and country feelings" is built to deeply integrate value guidance with knowledge imparting <sup>[8]</sup>. Through the path of content reconstruction, a three-level ideological and political mapping framework of "concept-principle-application" is established: systematically exploring Marxist standpoints, viewpoints, and methods within the professional knowledge system <sup>[9]</sup>. For example, in the postgraduate course "Machine Learning", taking the cultivation of the "spirit of exploration" as a case, efforts are made from both ideological and practical aspects. Through the idea of algorithm iteration, students are guided to establish the concept of striving for excellence. Relying on projects such as data-driven industrial intelligence in "Made in China 2025", students' spirit of

exploration is cultivated <sup>[10]</sup>.

### **3.1.2. Innovation in teaching design**

A three-stage progressive model of “knowledge acquisition-value internalization-practical innovation” is constructed <sup>[11]</sup>. For instance, in electronic information majors, through teaching the development history of 5G technology, students are guided to understand the strategic significance of independent and controllable key technologies; by learning knowledge about various recommendation algorithms and data mining-related algorithms, students are guided to think about the benefits brought by the continuous improvement of artificial intelligence recommendation algorithms and the threats such as data privacy and security, based on the phenomenon that shopping platforms and short video platforms can infer the items or videos that users may be interested in through the click rate of items or the types of videos liked and collected. An innovative problem-oriented teaching model is adopted to transform practical issues, such as tackling “bottleneck” technologies, into teaching cases, to cultivate students’ feelings for their country while solving engineering problems <sup>[12]</sup>. For example, through the dispute over the source of Huawei’s chip technology, students can learn that China has improved chip manufacturing processes through continuous high-intensity technological research and development and investment, avoiding the situation where foreign countries contain the iterative upgrading of China’s high-tech industry. This enables students to understand the correctness of China’s adherence to the strategy of building a strong country through science and technology, and establish the awareness of continuously improving technological research and development capabilities and achieving self-reliance and self-improvement in science and technology. Another example is the invasion of the space elevator in the movie *The Wandering Earth 2*, which introduces issues such as network security and information security that the country attaches great importance to, helping students realize that the security of critical information infrastructure is directly related to national security. Given that current artificial intelligence is becoming increasingly advanced, network security threats and risks are prominent, guiding students to establish a correct concept of network security.

## **3.2. Exploration of training approaches for balancing professional practice and scientific research**

### **3.2.1. Optimizing the training system**

Reconstruct literacy indicators to resolve structural contradictions in engineering education and achieve in-depth integration of industry and education. Through value-oriented literacy anchoring, precisely deconstructed capability maps, and data-driven dynamic adjustment, a new training ecosystem of “value shaping-capability development-continuous evolution” is built. Value orientation establishes a coordinate system for core literacy, focusing on three key aspects: “degree of anchoring to family and country feelings”, “degree of internalization of scientific and technological ethics”, and “degree of contribution to innovative breakthroughs”. It translates the goal of fostering virtue through education into industry-urgently-needed qualities such as “sense of responsibility for carbon peak”, “spirit of tackling challenges in new power systems”, etc. Deconstructing the elements of technological innovation capability to generate a literacy map, a stepped capability chain of “basic ability-advanced ability-breakthrough ability” is constructed, forming a visual model of capability growth trajectory <sup>[13]</sup>. Through intelligent investigation and response to industry needs, tracking and analyzing the growth and development patterns of graduates, an adaptive iteration mechanism is established to realize a qualitative upgrade from knowledge-memorizing talents to literacy-generating talents.

### **3.2.2. Optimizing the curriculum system**

Construct a three-level curriculum system of “basic theory-technical application-engineering practice”. Compress the traditional 1-year theoretical courses to 0.5 years, and add 0.5 years of courses on disciplinary frontiers, academic seminars, and disciplinary practice. Under the guidance of supervisors (teams), graduate students are introduced to cutting-edge technologies in fields related to their research topics, guiding them to seek intersections through extensive exposure, stimulating their interest in scientific research. Through disciplinary practice, supervisors set up enterprise horizontal projects or self-selected topics for application project practice, laying the groundwork for entering research and engineering applications.

### **3.2.3. Reforming the evaluation mechanism for scientific research achievements and thesis**

Allow high-level national innovation and entrepreneurship competition awards (such as “Internet+” or “Challenge Cup”), patent authorization (utility model or above), industry standard formulation, and solutions to major engineering problems to replace the requirements for traditional scientific research papers; improve the thesis evaluation system. Measure the completion of engineering master’s theses through quantitative evaluation of process documents such as professional practice logs, technical iteration reports, and customer demand analysis, as well as enterprise practice satisfaction and project completion, to increase the blind review pass rate.

### **3.2.4. Optimizing the school-enterprise collaborative training mechanism**

Build a school-enterprise collaborative education mechanism with in-depth integration of industry, academia, and research. By integrating enterprises’ high-quality technical resources and educational elements, jointly construct a cluster of research topics with theoretical innovation value and engineering transformation potential, forming a positive interaction pattern between knowledge production and application transformation<sup>[14]</sup>. In this process, enterprises need to break through traditional cognitive frameworks and deeply understand the particularity of graduate training compared with undergraduate practical teaching. Its essence is to build an innovation ecosystem based on complex engineering scenarios, rather than skill-oriented job adaptability training. A development model for graduate students’ engineering innovation capabilities should be established, focusing on cultivating their technical foresight, system optimization, and interdisciplinary solution design capabilities, avoiding simplifying high-end talent training into a “project intern” training model at the technical operation level.

For graduate students themselves, it is necessary to systematically strengthen scientific research methodology training, including but not limited to the ability of critical literature analysis, experimental design paradigm transformation, and independent planning of technical routes. By establishing university-enterprise joint laboratories and implementing a dual-tutor system, postgraduates are guided to proactively develop a bidirectional transformation mindset between “theory and practice”, enabling the dynamic reconstruction of their knowledge graphs in the process of solving real engineering problems. Through the spiral improvement of “academic research-industrial application”, improve the talent training paradigm of industry-education integration, and more substantially enhance graduates’ competitiveness in career development.

## **3.3. Research on the collaborative mechanism for the reconstruction of tutor roles and capacity enhancement**

As the core leaders in the academic growth process of postgraduates, the educational effectiveness of postgraduate tutors is mainly reflected in two dimensions: demonstration effect and guidance strategies. In the process of talent cultivation, tutors should strive to cultivate postgraduates’ awareness of independent inquiry and



critical thinking ability through academic demonstration and value guidance, enabling them to deeply understand the survival principle in the era of knowledge economy that “only by being brave in exploring, thinking, and learning new knowledge throughout life can one achieve lifelong employment”<sup>[15]</sup>.

In specific guidance practices, tutors should construct diversified guidance paradigms, including but not limited to academic lectures, subject seminars, and personalized guidance. They should adopt heuristic teaching strategies to guide students to complete the entire research chain of “problem discovery-scheme construction-practice verification”. The frequency and depth of guidance should follow the “demand-oriented principle”. For the phased confusion encountered by postgraduates in such dimensions as academic development, scientific research training, and career planning, tutors should intervene in a timely manner and provide systematic solutions.

To achieve the continuous optimization of the professional literacy of the tutor team, it is necessary to build a normalized and institutionalized academic exchange system. Relying on carriers such as international academic conferences, frontier discipline forums, and thematic research workshops, it can drive the iterative update of tutors’ academic cognitive systems and the systematic improvement of their guidance effectiveness. On this basis, a systematic support framework for tutor development should be planned. Through a three-level linkage mechanism of pre-service standardized training, modular thematic studies, and periodic continuing education, emphasis should be placed on strengthening their professional development in key literacy dimensions such as awareness of scientific research ethics and norms, innovation in guidance paradigms, and interdisciplinary dialogue ability.

By establishing a multi-dimensional comprehensive evaluation mechanism, academic achievements, talent cultivation quality, and the construction of teachers’ ethics and conduct are quantified into parameters. A tutor evaluation and feedback system is set up to form a closed-loop management model of “evaluation-feedback-improvement”. This ensures the collaborative development of the tutor team in such dimensions as academic leadership, educational innovation ability, and moral appeal, and ultimately achieves the sustainable development goal of high-quality construction of the teaching staff.

## 4. Conclusion

The reform of postgraduate education and teaching is a multi-dimensional and collaborative systematic project. This paper explores three aspects: the transformation of the ideological and political education model in courses, the exploration of training approaches balancing professional practice and scientific research, and the collaborative mechanism for the reconstruction and capacity improvement of supervisors. It aims to promote an education model where professional cognition and ideological and political education resonate in harmony, strive to embed elements of value shaping in the process of knowledge construction, form a three-in-one training system integrating academic ability, engineering ethics, and patriotism, and realize the collaborative cultivation of postgraduates’ academic interests, innovative capabilities, and practical literacy.

## Disclosure statement

The author declares no conflict of interest.



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# Research on the Application of Virtual Simulation Technology in Higher Vocational Education Teaching

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**Abstract:** In the era of artificial intelligence, virtual simulation technology has injected vitality into the reform of higher vocational education. It is conducive to innovating practical teaching models, improving students' practical abilities, enabling real-time monitoring of the teaching process, and carrying out precise teaching, thereby enhancing teaching quality. This paper analyzes the importance of applying virtual simulation technology in higher vocational education and teaching, examines the current status of its application, and proposes approaches to promote high-quality development of higher vocational education, such as building virtual simulation training bases through school-enterprise cooperation, compiling virtual simulation teaching cases, simulating typical work scenarios, conducting good virtual simulation data analysis, and improving skill evaluation and feedback mechanisms.

**Keywords:** Virtual simulation technology; Higher vocational education; Importance; Current teaching situation; Application paths

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## 1. Introduction

Virtual simulation technology, based on computer, electronic information, big data and other technologies, creates realistic virtual scenes that can meet the needs of different scenarios. It brings users realistic visual and tactile experiences, allowing them to enjoy unique learning, entertainment and tour experiences. Virtual simulation technology can meet the teaching needs of different majors, help higher vocational teachers create various teaching situations and work scenarios, and enable students to conduct online simulation operation exercises, thereby improving their practical operation abilities. Based on this, higher vocational colleges should cooperate with enterprises to establish high-level virtual simulation training bases, develop virtual simulation textbooks and cases, monitor the teaching process in real time, adjust teaching contents and methods in a timely manner, and comprehensively improve the quality of vocational education.

## **2. The importance of virtual simulation technology in higher vocational education and teaching**

### **2.1. Conducive to improving the quality of practical teaching**

Virtual simulation technology has innovated the practical teaching methods in higher vocational education, which applies to various majors. It helps teachers build virtual scenarios according to teaching contents and monitor students' online operation processes in real time, so as to find out the problems in their actual operations, carry out targeted online evaluation and guidance, standardize students' operation steps, and thus is beneficial to improving the quality of practical teaching<sup>[1]</sup>. At the same time, virtual simulation technology can alleviate the problem of insufficient high-end training equipment in some higher vocational colleges. It can simulate typical work case scenarios, allowing each student to conduct online simulation operation training, thereby expanding the content of practical teaching, creating more training space for students, and helping to improve the quality and effectiveness of practical teaching.

### **2.2. Conducive to enhancing students' practical ability**

With the support of virtual simulation technology, teachers in higher vocational colleges can simulate enterprise production scenarios, import relevant equipment parameters, create realistic enterprise production scenes, record standardized operation videos, guide students to carry out online simulation operation exercises, help them practice operation steps repeatedly, deepen their memory of production processes, and thus be conducive to improving students' practical ability in posts. In addition, virtual simulation technology helps teachers carry out precise teaching and enables them to monitor and comment on students' online operation processes in real time. For example, students' operations can be evaluated according to the sequence and data of their online operations, and the evaluation results can be fed back to teachers and students. This facilitates teachers to carry out personalized guidance and students to conduct targeted exercises, thereby improving students' practical operation ability<sup>[2]</sup>.

### **2.3. Conducive to building an integrated teaching system of industry, education, research and application**

Higher vocational colleges should actively introduce virtual simulation technology and improve software and hardware facilities to promote the connection between industrial development, professional teaching, scientific research, and enterprise production, accelerate the construction of an integrated teaching system of industry, education, research, and application, and thus promote the high-quality development of vocational education. Virtual simulation technology helps teachers in higher vocational colleges simulate intelligent production, animal husbandry, and other scenarios, make up for the deficiencies of traditional practical teaching modes, enable students to keep abreast of cutting-edge scientific research achievements, new technologies, and new concepts in the industry, and allow them to simulate participating in front-line production, clinical treatment, and other work online. In this way, students can transform their professional course achievements into productivity, which is conducive to improving their practical ability and professional ethics, thus improving the industry-education-research-application system of higher vocational colleges and enhancing the quality of education and teaching<sup>[3]</sup>.

## **3. Current application status of virtual simulation technology in higher vocational education teaching**

### **3.1. Virtual simulation software and hardware facilities need to be optimized**

VR glasses, VR headsets, and professional virtual simulation platforms are the foundation for integrating virtual

simulation technology into higher vocational education and teaching, and also important factors affecting the quality of virtual simulation teaching. Due to the high cost of these devices and high maintenance expenses, higher vocational colleges are facing financial constraints, making it difficult to purchase a large number of devices such as VR glasses and VR headsets. This leads to insufficient equipment quantity, with the problem of multiple students sharing one device, which affects the quality of practical teaching<sup>[4]</sup>. At the same time, the update of virtual simulation training software in schools is not timely, making it difficult to import parameters of new technologies and equipment in the industry. The created virtual simulation scenarios are relatively simple, and the image quality is not clear enough, which affects students' experience in virtual simulation training.

### **3.2. There is little cooperation between schools and enterprises in virtual simulation teaching**

School-enterprise cooperation is one of the main education and teaching as well as talent training models in higher vocational colleges. However, its application in the construction of virtual simulation training bases and the development of teaching resources is relatively limited, which affects the application and promotion of virtual simulation technology in higher vocational education and teaching<sup>[5]</sup>. For example, schools and enterprises have not jointly invested in the establishment of virtual simulation training rooms, resulting in aging equipment in the training rooms, which hinders the development of training teaching. In addition, the joint development of virtual simulation textbooks is neglected, and typical enterprise work cases and production processes are not integrated into virtual simulation teaching, which invisibly affects the quality of school-enterprise cooperative education.

### **3.3. Virtual simulation teaching resources are single**

Virtual simulation teaching in higher vocational colleges mainly relies on textbooks of various majors, and is carried out in combination with the content of experimental teaching and training teaching. There is a lack of project-based textbooks compiled and digital teaching resources developed based on industrial development and typical enterprise work cases, which affects the connection between industrial development, post skills, and teaching content, and is not conducive to cultivating students' practical ability. Moreover, at present, there is a shortage of digital teaching resources for virtual simulation technology, and there are no video tutorials on virtual simulation technology operation or operation manuals for virtual simulation experiment software. This affects students' understanding of virtual simulation technology and brings considerable challenges to the implementation of virtual simulation teaching<sup>[6]</sup>.

## **4. Application paths of virtual simulation technology in higher vocational education and teaching**

### **4.1. School-enterprise cooperation to establish virtual simulation training bases**

Higher vocational colleges should make good use of school-enterprise cooperation platforms to jointly build virtual simulation training bases, realize the optimal allocation of educational resources, and thus improve the quality of school-enterprise cooperation. Taking animal husbandry majors as an example, higher vocational colleges should introduce virtual simulation technology according to their professional characteristics, deepen cooperation with farms, veterinary stations, and pet hospitals, jointly establish virtual simulation training bases, and equip them with VR glasses, VR helmets, and virtual simulation experiment software to meet the training teaching needs of animal husbandry majors and lay a good foundation for improving the quality of training



teaching<sup>[7]</sup>. For example, schools and enterprises can jointly invest in purchasing relevant equipment to build a comprehensive and intelligent virtual simulation training base, divided into four training functional areas: animal medicine, animal pharmacy, pet medical care, and modern animal husbandry, equipped with VR glasses or helmets, projectors, and operating platforms to meet the training teaching needs of animal husbandry majors. In addition, schools should actively introduce advanced enterprise equipment, such as various animal medical inspection equipment and examination equipment, to lay a good foundation for the development of virtual simulation training teaching and enable students to master professional equipment operation skills in advance. For example, schools and enterprises can introduce blood testing and X-ray equipment from pet hospitals, connect them with virtual simulation experiment software, simulate pet hospital consultation and treatment scenarios, facilitate students' online simulation operations, intuitively display students' operation processes, and thus improve the quality of training teaching<sup>[8]</sup>.

#### **4.2. Using virtual simulation technology to simulate typical work scenarios**

Higher vocational teachers should actively learn virtual simulation technology, master the operation process of virtual simulation experiment software, and the parameter design skills of VR glasses and helmets, to improve their ability to apply virtual simulation technology and use it to improve teaching quality. Firstly, teachers can use virtual simulation technology to simulate typical work situations, carry out situational teaching, guide students to be immersed in virtual scenarios to learn professional knowledge, help them master abstract and complex core concepts, experimental operations, and other knowledge, and improve their learning efficiency and quality<sup>[9]</sup>. For example, teachers of animal husbandry majors can create virtual teaching scenarios according to the key points of course teaching, simulate the experimental process of poultry and livestock breeding, and the process of preparing drugs and treating avian influenza, guide students to wear VR glasses to enter the virtual scenarios, and let them learn knowledge such as animal genetics and breeding, common diseases of livestock and their treatment methods in the scenarios, to improve the quality of classroom teaching. Secondly, teachers can collect cutting-edge breeding technologies and veterinary technologies in animal husbandry, clarify industry development trends and enterprise talent needs, collect typical cases, and then use virtual simulation technology to simulate typical work scenarios, promote the connection between industry development, post skills, and classroom teaching, and thus improve students' practical ability in posts<sup>[10]</sup>.

#### **4.3. Joint compilation of virtual simulation teaching cases by schools and enterprises**

Higher vocational colleges should integrate virtual simulation technology into the design of teaching cases. On the one hand, they should explain in detail the connotation of virtual simulation technology, operation processes, and the operation skills of virtual simulation experiment software, guiding students to use virtual simulation technology to learn professional knowledge; on the other hand, they should compile virtual simulation teaching cases and implement project-based teaching to improve students' autonomous learning ability<sup>[11]</sup>. Taking the teaching of animal husbandry majors as an example, teachers can compile teaching cases combined with training teaching content, integrate virtual simulation technology into case design, explain to students the application of virtual simulation technology in fields such as animal medical inspection, animal husbandry and veterinary medicine, pet medical care, and animal breeding, stimulate students' enthusiasm for learning virtual simulation technology, improve their information literacy, and gradually guide them to use virtual simulation technology to learn animal husbandry professional knowledge, enrich their professional knowledge reserves, and improve their comprehensive ability. In addition, schools can jointly compile virtual simulation teaching cases with enterprises,



compile project-based teaching cases around modern animal husbandry, animal medicine, animal pharmacy, and pet medical care, intersperse virtual simulation experiment cases, clarify the operation process of the virtual simulation experiment platform, and match relevant experimental operation videos, so that students can master professional knowledge according to virtual simulation experiment cases<sup>[12]</sup>. For example, teachers can compile virtual simulation experiment cases of ear mite bacteria in pet cats, use videos to explain the experimental operation process and experimental data, and synchronize the cases in WeChat groups and online teaching platforms, so that students can understand the content of virtual simulation experiment teaching in advance and lay a good foundation for the development of virtual simulation experiment teaching.

#### **4.4. Comprehensive analysis of virtual simulation teaching data**

Firstly, teachers should regularly summarize the data of the virtual simulation experiment platform, analyze the download volume of demonstration experiment videos and courseware, and students' experimental operation steps, focus on evaluating whether students' experimental steps are correct, whether experimental data are standard, and whether experimental reports are complete, find out the problems existing in students' virtual simulation experiment operations, provide accurate data for offline experimental teaching, facilitate personalized guidance, and thus improve students' experimental operation ability<sup>[13]</sup>.

Secondly, teachers can use virtual simulation technology to carry out online tests, design test experiments on animal breeding, animal husbandry and veterinary medicine, pet medical care, and animal medical inspection, require students to complete experimental operation tasks and submit experimental reports within a specified time, and set relevant standard parameters for experimental operations to realize intelligent monitoring and evaluation, and improve the accuracy and scientificity of virtual simulation experimental data analysis. For example, teachers can use virtual simulation experiment software to intelligently analyze students' experiment videos, accurately find out students' operation errors and data problems, realize intelligent monitoring and evaluation, and give full play to the advantages of virtual simulation technology in higher vocational education and teaching<sup>[14]</sup>.

#### **4.5. Improving the teaching evaluation and feedback mechanism**

Firstly, higher vocational teachers should join hands with enterprise experts to participate in the evaluation of virtual simulation experiment teaching, allowing them to remotely evaluate the virtual simulation experiment teaching process and students' virtual simulation experiment practice videos, point out the existing problems, and improve the scientificity and practicality of virtual simulation teaching evaluation. Secondly, teachers should comprehensively analyze students' messages, evaluations, and suggestions on the virtual simulation training platform, understand the professional knowledge, employment information, and vocational skills assessment they are interested in, collect relevant teaching resources in a targeted manner, meet students' personalized learning needs, and thus stimulate their enthusiasm for autonomous learning<sup>[15]</sup>. Taking animal husbandry majors as an example, teachers can produce videos on pet grooming, common disease treatment of pet cats and dogs, and dairy cow breeding technology according to students' evaluations and feedback, and make supporting operation videos to facilitate students' online autonomous learning, enrich their professional knowledge reserves, and thus improve their professional learning ability and lay a good foundation for their future employment.

### **5. Conclusion**

In conclusion, higher vocational colleges should actively promote and apply virtual simulation technology. They

should build virtual simulation teaching bases through school-enterprise cooperation platforms, compile virtual simulation teaching cases, and innovate practical training teaching methods to improve the quality of practical training teaching. The use of virtual simulation technology in experimental and practical training teaching allows students to conduct online virtual operation exercises, enhancing their practical operation abilities and cultivating more practical and skilled talents. In addition, teachers in higher vocational colleges should use virtual simulation technology to simulate typical work scenarios, guide students to master job skills in virtual environments, thereby improving their practical capabilities. They should also conduct data analysis on virtual simulation experimental teaching and case teaching, improve the teaching model, and comprehensively enhance the quality of vocational education.

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# Research on the Practical Paths and Strategies of Integrating Traditional Chinese Culture Education into “One-Stop” Student Communities

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**Abstract:** Excellent traditional Chinese culture, which can cultivate students’ sentiments and shape their values, serves as an important resource for ideological and political education. In the context of the times, counselors integrating excellent traditional Chinese culture education into “one-stop” student communities enrich the content and innovate the forms of ideological and political education. This practice is of great practical significance, as it enhances students’ cultural confidence, improves their cognitive abilities, and encourages them to become disseminators and promoters of excellent traditional Chinese culture. Therefore, the author first analyzes the necessity of integrating traditional Chinese culture education into “one-stop” student communities, and then explores its practical paths and strategies based on the needs of students’ all-around development, aiming to provide theoretical reference and practical guidance for culture-based education and ideological and political education.

**Keywords:** Traditional Chinese culture; “One-Stop” student community; Practical path; Educational strategy

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## 1. Introduction

The “one-stop” student community provides a practical carrier for the concept of “three-full education” (full-process, all-round, and whole-staff education), and serves as an important grasp for counselors to promote educational reforms in colleges and universities and broaden the channels of ideological and political education. Meanwhile, the “Opinions on Accelerating the Construction of the Ideological and Political Work System in Colleges and Universities” clearly states that colleges and universities should comprehensively promote the construction of “one-stop” student communities, creating a new education model integrating education, management, and services. The “Opinions on Implementing the Project for the Inheritance and Development of Excellent Traditional Chinese Culture” requires colleges and universities to integrate excellent traditional Chinese culture into the entire process of education and teaching. Against this background, counselors need to actively explore effective strategies to integrate excellent traditional Chinese culture into “one-stop” student communities,

so as to enrich the theoretical research results and practical methods of ideological and political education.

Currently, counselors generally recognize the importance of integrating excellent traditional Chinese culture into “one-stop” student communities and have made many beneficial attempts. However, in the process of educational practice, there are still problems such as a single form of integration and low student participation, which, to a large extent, restrict the improvement of educational effectiveness. In order to further exert the educational role of excellent traditional Chinese culture, give play to the advantages of “one-stop” student communities, such as spatial agglomeration, functional integration, and proximity to students’ lives, and expand the educational platform, counselors should organically integrate the two. Compared with traditional educational methods, this approach can enrich the dimensions of cultural education, enhance the affinity and appeal of ideological and political education, and touch students’ hearts. The author researched the “one-stop” student community of our university, analyzed typical cases of integrating excellent traditional Chinese culture into “one-stop” student communities, and then constructed practical paths and strategies that meet actual needs, in order to provide a reference for the development of related educational work.

## **2. Analysis on the necessity of integrating excellent traditional Chinese culture into the “One-Stop” student community**

### **2.1. An inevitable requirement for implementing the fundamental task of morality education**

Excellent traditional Chinese culture is the crystallization of the nation’s wisdom, which contains a wealth of ideological and political education elements. For example, “everyone is responsible for the rise and fall of the country”, “do not do to others what you do not want others to do to you”, “promises must be kept and actions must be resolute”, etc. Counselors integrate these into the “one-stop” student community to cultivate students’ feelings of family and country, integrity, and guide students to learn the correct way of dealing with others, which is of great significance for implementing the fundamental task of morality education. Therefore, integrating excellent traditional Chinese culture into the “one-stop” student community is an effective way to present abstract ideological and political knowledge in a vivid and life-oriented manner, so as to influence and touch students, and it is also an inevitable requirement for implementing the fundamental task of morality education <sup>[1]</sup>.

### **2.2. An effective way to enhance cultural confidence**

Surveys show that college students’ understanding of excellent traditional Chinese culture is fragmented and superficial. For example, only a small number of the student samples who participated in this survey can completely tell which classics are included in the “Four Books” and accurately state the origin of traditional cultural festivals. This reflects that contemporary college students lack cultural confidence, which is related to the deficiency in the education of excellent traditional Chinese culture. Counselors integrating excellent traditional Chinese culture into the “one-stop” student community, creating a strong cultural atmosphere, and enriching the forms of students’ cultural practice activities can effectively solve the problems in education in this aspect. Integrating excellent traditional Chinese culture into the “one-stop” student community and making it part of students’ campus life can strengthen students’ learning and understanding of excellent traditional Chinese culture and enhance their sense of identity with it.

### **2.3. An important measure to improve the “Three-Full Education” system**

Integrating excellent traditional Chinese culture into the “one-stop” student community can promote educational



activities to extend from the classroom to students' actual life, promote the diversification of educational subjects, and promote the transformation of educational methods from "preaching" to practical activities. Therefore, it is an important measure to improve the "Three-Full Education" system and an important aspect of the current reform of higher education. Relevant educational data analysis results show that after excellent traditional Chinese culture is integrated into the "one-stop" student community, students' enthusiasm for participating in ideological and political activities has been significantly improved, and their sense of identity with the school has also been significantly enhanced <sup>[2]</sup>.

### **3. Practical approaches to integrating excellent traditional Chinese culture into "One-Stop" student communities**

#### **3.1. Environmental immersion: creating a cultural education space for traditional culture**

The "one-stop" student community extends traditional culture education from the classroom to students' daily lives, breaking through spatial limitations <sup>[3]</sup>. In the new era, colleges and universities can create traditional culture-themed landscapes in "one-stop" student communities. For example, in the public areas of student dormitories, "cultural corridors" and "local intangible cultural heritage display corners" can be set up to showcase local characteristic traditional culture and create a strong atmosphere of traditional culture. They can also transform students' living spaces with traditional culture education, integrating traditional cultural elements into the decoration design of student dormitories. Such a transformation of living spaces can significantly improve students' average score of civilized literacy. In addition, it is necessary to build digital spaces full of traditional cultural elements, such as the "Cloud Sinology Platform," to facilitate students' learning of traditional culture anytime and anywhere <sup>[4]</sup>.

#### **3.2. Education through activities: building a practical system for traditional culture**

In the construction of "one-stop" student communities based on traditional Chinese culture, emphasis should be placed on building a cultural practice system and achieving the goal of educating through activities. The main types of activities include the following three:

- (1) Regular activities, such as monthly "Sinology lectures" and "classic reading sessions" <sup>[5]</sup>. A certain university has persisted in holding "morning reading of classics" activities, with the cumulative number of participating students exceeding 10,000.
- (2) Festival activities, such as special activities like paying tribute to martyrs on Qingming Festival, making zongzi on Dragon Boat Festival, and holding mid-autumn poetry gatherings on Mid-Autumn Festival.
- (3) Innovative activities. Currently, new forms of activities such as traditional culture, creativity competitions and Hanfu shows are popular among students <sup>[6]</sup>.

#### **3.3. Curriculum integration: improving the education system for traditional culture**

Curriculum integration plays an important role in promoting the infiltration of traditional Chinese culture into "one-stop" student communities. Colleges and universities can strengthen curriculum integration and improve the traditional culture education system from the following three perspectives.

- (1) Infiltration of ideological and political courses in the community: Add special topics on traditional culture to ideological and political courses, such as party lectures and league lectures in the student community. Topics like "The Thought of Governance in the Analects" and "Traditional Family Instructions and

Modern Family Traditions” are of great interest to students.

- (2) Construction of general education courses in the community: Offer courses such as “Essence of Chinese Culture” and “Appreciation of Traditional Arts” in “one-stop” student communities.
- (3) Development of micro-courses: Produce micro-course videos with the theme of “Learning Sinology in Five Minutes” to facilitate students’ fragmented learning in the community<sup>[7]</sup>.

### **3.4. Team building: cultivating forces for educating with traditional culture**

To strengthen the educational forces of traditional culture and promote its effective infiltration into “one-stop” student communities, colleges and universities should attach importance to the construction of professional university teams, student backbone teams, and social support teams.<sup>[8]</sup> Among them, the professional university team refers to a guidance team composed of counselors, ideological and political theory teachers, cultural course teachers, sinology researchers, scholars, etc. This team needs to regularly organize students to participate in traditional culture activities. The student backbone team, as the name implies, is a team of traditional culture propagandists composed of students. It can play a leading role among peers and encourage students to actively participate in relevant cultural activities. The social support team integrates social resources for traditional culture education. Colleges and universities can invite intangible cultural heritage inheritors and cultural masters to the campus to display traditional culture for students. For example, a certain university has cooperated with the local cultural center to establish an off-campus tutor pool of 20 people, achieving good results in promoting traditional culture.

### **3.5. Mechanism guarantee: building an education system for traditional culture**

In the application of excellent traditional Chinese culture in “one-stop” student communities, it is necessary to strengthen mechanism guarantees and lay a solid foundation for relevant educational work.

- (1) Organizational leadership mechanism: Establish a special working group led by school leaders, and incorporate traditional culture education into the overall planning of community construction.
- (2) Resource integration mechanism: Allocate special funds. A certain university invests 500,000 yuan annually in community cultural construction.
- (3) Evaluation and incentive mechanism: Specifically, it refers to incorporating traditional culture literacy into students’ comprehensive quality evaluation and setting up honors such as “Cultural Heritage Award”<sup>[9]</sup>.

## **4. Implementation strategies for integrating traditional Chinese culture education into the “One-Stop” student community**

### **4.1. Adhere to value guidance and highlight educational effectiveness**

In the current construction of “one-stop” student communities in colleges and universities, emphasis should be placed on the value guidance of community culture. Effective measures should be taken to build brands of traditional cultural activities and improve the working model of cultural education, to further exert the leading role of traditional Chinese culture<sup>[10]</sup>. This means that efforts should be made to create a “boom” of traditional culture in the community, strengthen value guidance for students through community cultural construction, and enhance the effectiveness of cultural education. For example, with cultural education as the orientation, various art competitions can be organized to encourage students to learn traditional culture, enhance friendships, and enrich their spiritual world in these activities; through various measures of “educating people through culture”,

traditional culture can be disseminated among students, prompting them to improve their ideological realm in the process of learning traditional culture and then take the initiative to standardize their daily behaviors <sup>[11]</sup>.

#### **4.2. Focus on school-specific measures and build characteristic brands**

Colleges and universities should construct “one-stop” student communities in combination with their own school-running characteristics. For instance, traditional Chinese medicine colleges can integrate TCM culture into the community, while normal universities can incorporate the spirit of educators, allowing students to inherit the essence of traditional culture in community activities. When students live in a community environment with a strong cultural atmosphere for a long time, they will unconsciously learn traditional culture and demand themselves according to the professional ethics required by traditional culture. Taking engineering colleges as an example, they should organize activities to learn the craftsmanship spirit of outstanding historical craftsmen, such as Lu Ban, in the construction of “one-stop” student communities in light of their own characteristics, enabling students to understand the relevant ideas in traditional culture.

#### **4.3. Strengthen digital empowerment and innovate dissemination methods**

Against the backdrop of educational digital transformation, the construction of “one-stop” student communities should attach importance to technological empowerment, and carry out traditional culture education through various digital teaching resources, platforms, and tools, thereby innovating the dissemination methods of traditional culture among students <sup>[12]</sup>. For example, colleges and universities can use virtual reality technology to restore some famous historical scenes, allowing students to learn historical knowledge and perceive the influence of traditional culture in the virtual space; they can publicize traditional culture through platforms such as Douyin and Kuaishou, enrich students’ entertainment life, and prompt them to improve their cultural literacy and enhance cultural identity in the process of “playing” <sup>[13]</sup>. On the basis of developing these digital channels for traditional culture education, colleges and universities can also develop game mini-programs, such as “Sinology Pass,” to enable students to contact and understand traditional culture in games. Compared with traditional ways of disseminating traditional culture, game mini-programs are equipped with different levels and corresponding reward mechanisms, which can enhance students’ sense of gain and accomplishment and improve user stickiness among students.

#### **4.4. Promote collaborative education and form a joint workforce**

The “school-family-society” collaborative mechanism can form a joint work force, promoting the effective and all-round integration of traditional Chinese culture education into the “one-stop” student community <sup>[14]</sup>. In the construction of “one-stop” student communities, it is necessary to innovate thinking, use various cooperation methods to jointly formulate traditional culture education plans with qualified social organizations, students, and parents, and move the location of traditional culture education from colleges to families and cultural venues, to encourage students to learn more about traditional Chinese culture. For example, a university has significantly improved the educational effect through activities such as the “Home-School Cultural Festival” <sup>[15]</sup>.

### **5. Conclusion**

In the new era, integrating traditional Chinese culture education into the construction of “one-stop” student communities is both feasible and inevitable. This not only promotes educational reform, but also enriches

students' learning experience of traditional culture and enhances their satisfaction with educational management work. In the future, colleges and universities should strengthen the exploration of integration methods, establish corresponding educational evaluation mechanisms, and then further adjust the integration methods of traditional Chinese culture based on the evaluation results.

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# Construction and Practice of Functional Pavement Structures and Materials from the Perspective of Curriculum Ideology and Politics

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**Abstract:** With the proposal of the fundamental task of “fostering virtue through education,” ideological and political education in colleges and universities has ushered in new opportunities for reform. In this context, how to more effectively cultivate students’ ideological and political literacy and help them establish correct ideological concepts and value perceptions has become one of the teaching challenges perplexing college teachers. Integrating curriculum ideology and politics into the teaching of Functional Pavement Structures and Materials can not only enrich teaching content, expand teaching forms, and effectively stimulate students’ interest in learning, but also infiltrate ideological and political education while imparting professional knowledge, achieving the organic unity of knowledge transmission and value guidance. It can be said to serve multiple purposes. In this regard, this paper first briefly analyzes the teaching of Functional Pavement Structures and Materials from the perspective of curriculum ideology and politics, hoping to provide some valuable references for readers.

**Keywords:** Curriculum ideology and politics; Functional Pavement Structures and Materials; Construction

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## 1. Introduction

“Functional Pavement Structures and Materials” is a core course in civil engineering-related majors, playing an important role in cultivating students’ professional knowledge and skills. However, in previous course teaching, some teachers often focused on imparting professional knowledge and skills while neglecting the cultivation of students’ ideological and political literacy, which has had a certain impact on students’ all-round development <sup>[1]</sup>. In this regard, in the new era, colleges and universities should fully recognize the importance of the concept of ideological and political education in courses and integrate it into the teaching of Functional Pavement Structures and Materials. While imparting professional knowledge and skills to students, they should imperceptibly infiltrate

ideological and political education into them, helping students establish correct ideological concepts and value perceptions, thus laying the foundation for their all-round development in the future <sup>[2]</sup>.

## **2. Connotation and value of curriculum-based ideological and political education**

### **2.1. Connotation**

Curriculum-based ideological and political education is an innovative educational concept and one of the important approaches for ideological and political education in colleges and universities <sup>[3]</sup>. It mainly refers to the in-depth integration of ideological and political education with curriculum teaching. While imparting knowledge and skills to students, it imperceptibly infiltrates ideological and political education into them, shapes their excellent character, and enhances their sense of social responsibility and mission, thus laying a foundation for their all-round development in the future.

### **2.2. The value of integrating curriculum-based ideological and political education into the course “Functional Pavement Structure and Materials”**

Integrating curriculum-based ideological and political education into the course “Functional Pavement Structure and Materials” has important value <sup>[4]</sup>. In this regard, this paper makes a brief analysis of the following aspects.

#### **2.2.1. Enriching the teaching content of the course**

“Functional Pavement Structure and Materials” is a core course for civil engineering majors, mainly teaching students knowledge such as the selection of pavement materials, performance evaluation, and construction technology <sup>[5]</sup>. Some of the course knowledge is relatively professional and abstract, which increases the difficulty of learning the course. By integrating curriculum-based ideological and political education into the teaching of “Functional Pavement Structure and Materials,” teachers can introduce some engineering cases, hot issues, scientific stories, and other content. This not only enriches the teaching content, improves the teaching atmosphere, and stimulates students’ interest in learning, but also imperceptibly infiltrates ideological and political education into students, strengthens their sense of social responsibility and mission, and thus effectively promotes the all-round development of students.

#### **2.2.2. Implementing the fundamental task of moral education and talent cultivation**

In order to fully implement the fundamental task of moral education and talent cultivation, ideological and political education in colleges and universities has ushered in a new opportunity for reform. In this context, ideological and political education is no longer limited to the teaching of ideological and political courses, but is infiltrated into professional course teaching. While imparting professional knowledge to students, it also infiltrates ideological and political education, thereby improving the effectiveness of ideological and political education and better implementing the fundamental task of moral education and talent cultivation <sup>[6]</sup>. “Functional Pavement Structure and Materials” is one of the core courses for civil engineering majors, which contains rich ideological and political elements. Excavating and refining these elements can not only help students learn and master professional knowledge more deeply, but also effectively cultivate their professional ethics and innovative spirit, to train students into high-quality talents meeting the needs of the civil engineering industry and future social development.

### **2.2.3. Meeting the needs of the times**

With the rapid development of the construction industry, a large number of high-quality professional talents are urgently needed <sup>[7]</sup>. However, the construction industry has put forward higher requirements and standards for professional talents. They are required to not only have solid theoretical knowledge, strong practical ability and innovative ability, but also have lofty professional ethics, excellent character, and a strong sense of social responsibility and mission <sup>[8]</sup>. Integrating curriculum-based ideological and political education into the teaching of “Functional Pavement Structure and Materials” can not only enrich the teaching content, expand the teaching forms, and more effectively impart professional knowledge and skills to students, but also strengthen their sense of social responsibility, cultivate their moral qualities, and make them high-quality talents meeting the needs of the development of the times.

## **3. Problems in the teaching process of “Functional Pavement Structures and Materials” from the perspective of curriculum ideology and politics**

### **3.1. Outdated teaching models and dull classroom atmosphere**

Currently, in the teaching of “Functional Pavement Structures and Materials”, some professional teachers still adopt traditional and outdated teaching models <sup>[9]</sup>, such as “cramming” teaching and preaching-style teaching. They regard students as “containers” for knowledge, and students are often in a passive acceptance position. Their enthusiasm and initiative cannot be fully mobilized, resulting in a dull and oppressive classroom teaching atmosphere. This not only seriously affects the improvement of teaching effectiveness but also hinders the integration of ideological and political elements.

### **3.2. Backward teaching concepts and weak teacher literacy**

Teachers play an important role in promoting the construction of curriculum ideology and politics <sup>[10]</sup>. However, some professional teachers have backward teaching concepts, lack a comprehensive understanding and research on curriculum ideology and politics, and unilaterally believe that their own job is to impart professional knowledge and skills to students, while ideological and political education is the work of ideological and political course teachers, counselors, and class teachers. In actual teaching, they do not integrate ideological and political education into the curriculum, thus affecting the construction of curriculum ideology and politics. In addition, some teachers have weak teaching literacy and cannot flexibly integrate ideological and political courses into the teaching of “Functional Pavement Structures and Materials.” This not only affects the improvement of teaching effectiveness but also fails to give full play to the educational role of curriculum ideology and politics.

### **3.3. Imperfect evaluation system**

The evaluation system is one of the important measures to promote the construction of curriculum ideology and politics <sup>[11]</sup>. However, the evaluation systems of some colleges and universities are not perfect. On the one hand, the evaluation criteria are not comprehensive, mainly taking students’ exam scores, learning achievements, etc., as the main criteria for evaluating students, resulting in evaluation results that cannot fully reflect students’ comprehensive abilities. On the other hand, the evaluation methods are relatively single, mainly based on teacher evaluation, which cannot comprehensively evaluate students from multiple dimensions and levels, thus hindering the construction of curriculum ideology and politics to a certain extent.

## **4. Teaching innovation strategies for the course “Functional Pavement Structures and Materials” from the perspective of curriculum-based ideological and political education**

### **4.1. Adopting diversified teaching modes to cultivate students’ ideological and political literacy**

To successfully integrate curriculum-based ideological and political education into the teaching of “Functional Pavement Structures and Materials” and effectively address the issue of outdated teaching modes, teachers can adopt diversified teaching approaches. Based on teaching content and students’ learning conditions, they can flexibly employ various teaching modes and methods, such as case teaching, virtual reality technology, and project-based teaching, to stimulate students’ interest and improve teaching effectiveness<sup>[12]</sup>.

#### **4.1.1. Applying the case teaching method**

The case teaching method is an approach based on specific cases. By introducing real or virtual cases into teaching, it guides students to analyze and discuss them, helping them master professional knowledge more deeply and cultivate their ideological and political literacy<sup>[13]</sup>. For example, when teaching the content of “photocatalytic air-purifying pavements,” teachers can introduce a case like “an industrial park using this technology to reduce PM2.5 concentrations.” This strengthens students’ understanding, enabling them to recognize the significant role of innovative technologies in improving people’s livelihoods and enhancing their sense of social responsibility.

#### **4.1.2. Utilizing virtual reality technology**

Currently, cultivating students’ practical abilities has become one of the important goals of higher education. Introducing virtual reality technology into teaching can create various virtual scenarios according to teaching objectives and students’ learning conditions, allowing students to conduct practical operations and training in virtual environments, thereby effectively developing their practical skills. In this regard, teachers can integrate virtual reality technology into the teaching of “Functional Pavement Structures and Materials” to enhance teaching effectiveness and promote curriculum-based ideological and political education. For instance, when teaching “intelligent temperature-controlled pavement materials,” teachers can use the powerful functions of virtual reality technology to create virtual highway scenes, providing students with a profound learning experience and helping them master professional knowledge more thoroughly.

#### **4.1.3. Implementing project-based teaching method**

Project-based teaching is an innovative approach where teachers assign relevant project tasks based on teaching content and students’ learning conditions, requiring students to complete them. This helps students grasp professional knowledge more deeply and cultivates their teamwork, innovation, and practical abilities<sup>[14]</sup>. From the perspective of curriculum-based ideological and political education, teachers can apply this method in the teaching of “Functional Pavement Structures and Materials” to infiltrate ideological and political education while imparting professional knowledge, promoting students’ all-round development. For example, when teaching “research and development of environmentally friendly pavement materials,” teachers can design a project task such as developing an environmentally friendly pavement material. Students are required to complete the task in groups through collaboration. This not only helps students learn and master professional knowledge more deeply but also strengthens their teamwork, innovation, and practical abilities, achieving multiple goals at once.



## **4.2. Strengthening the construction of teaching staff and improving teachers' literacy and ability**

In the process of integrating ideological and political education into the teaching of Functional Pavement Structures and Materials, teachers play an important role. To give full play to the educational function of ideological and political education in courses and realize the organic unity of knowledge imparting and value guidance, colleges and universities should strengthen the construction of teaching staff and continuously improve teachers' literacy and ability.

### **4.2.1. Carrying out special training and academic exchange activities**

In the new era, it is necessary for colleges and universities to regularly organize teachers to participate in special training and academic exchange activities on ideological and political education in courses, such as training courses, teaching seminars, and academic forums. This can strengthen their cognition, enable professional teachers to have an in-depth and comprehensive understanding of ideological and political education in courses, innovate teaching concepts, and master advanced teaching models and methods. In addition, colleges and universities can invite well-known educational experts, outstanding front-line teachers, and scholars to the school to give special lectures or report meetings, sharing educational experiences and insights, so as to broaden teachers' horizons and improve their teaching level.

### **4.2.2. Formulating incentive mechanisms**

Moreover, colleges and universities can formulate a series of incentive mechanisms to fully mobilize teachers' enthusiasm for participating in ideological and political education in courses. For example, they can set up excellent teaching awards to reward teachers who have performed well in integrating ideological and political education into the teaching of Functional Pavement Structures and Materials. They can also regularly evaluate the teaching effect of ideological and political education in courses and link it with teachers' performance appraisal, professional title evaluation, and selection for awards and recognition. This will further enhance teachers' attention to ideological and political education in courses, prompting them to continuously innovate teaching models and methods, thereby effectively improving teaching effect and quality.

## **4.3. Optimizing the teaching evaluation system to ensure educational effectiveness**

The traditional evaluation system is not perfect and can no longer meet the needs of students' development <sup>[15]</sup>. In this regard, to integrate ideological and political education into the course of Functional Pavement Structures and Materials, improve the teaching effect, and cultivate students' ideological and political literacy, colleges and universities should build a sound evaluation system.

First, establish a comprehensive and scientific evaluation standard. Not only should examination results and learning achievements be taken as the standards for evaluating students, but also students' learning attitude, teamwork ability, innovation ability, and moral character should be included in the evaluation system. In this way, students can be evaluated more comprehensively, and the accuracy of evaluation results can be improved.

Second, adopt diversified evaluation methods. In the past, colleges and universities often used teacher evaluation, but teachers are prone to being affected by various factors, leading to unscientific evaluation results. In the new era, to promote the construction of ideological and political education in courses and promote the all-round development of students, colleges and universities can also adopt student self-evaluation, peer evaluation, and enterprise evaluation. By evaluating students from multiple perspectives and levels, the accuracy



of evaluation results can be improved. In addition, colleges and universities can adopt the “process + result” evaluation method, which not only evaluates students’ learning achievements but also their performance in the learning process, to improve the scientificity of evaluation results.

## 5. Conclusion

In summary, in the new era, colleges and universities, as well as teachers, should fully recognize the important value of ideological and political education in courses. They should integrate it into the teaching of Functional Pavement Structures and Materials through various methods and means. While imparting professional knowledge and skills to students, they should infiltrate ideological and political education, shape students’ excellent qualities, and strengthen their sense of social responsibility and mission. In this way, students can be cultivated into high-quality talents who meet the needs of industrial and social development.

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# Using Drawing Assignments to Improve the Effectiveness of After-Class Review for Regional Anatomy

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**Abstract:** Regional Anatomy is a compulsory clinical course for medical students, focusing on morphological science. The study of the adjacency and layers of human morphological structures should always be illustrated with images. Based on the “blended teaching model” implemented by the teaching and research section, the research team effectively adopted the traditional drawing method and carried out after-class consolidation of the Regional Anatomy course through drawing assignments via the Xuexitong APP for clinical students of the 2022 cohort. Results showed that compared with the control group, the experimental group with after-class drawing assignments achieved significantly higher scores in both specimen practice assessments and final theoretical exams. This study aims to retain the advantages of traditional teaching models while accumulating experience for the application of blended teaching models in teaching practice.

**Keywords:** Xuexitong; Regional anatomy; Drawing; After-class review

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## 1. Introduction

Regional anatomy is a compulsory clinical course for clinical medicine majors, characterized by strong practicality. On the basis of systematic anatomy, it plays a key role in helping students connect basic medicine with clinical medicine. Therefore, mastering regional anatomy is crucial for students' subsequent practice in clinical courses. Against the backdrop of the mobile Internet era, the teaching and research section where the author works has gradually transformed the traditional “regional anatomy classroom” into an “online + offline” blended teaching mode based on the Erya platform in recent years (hereinafter referred to as the blended teaching mode) <sup>[1,2]</sup>. In the process of teaching practice, the author found that the blended teaching mode has obvious advantages and characteristics compared with traditional teaching methods. However, some advantages of the traditional teaching mode can also be continued in the new teaching mode.

Regional anatomy is a morphological science. The study of the adjacency and layers of human

morphological structures should always be accompanied by images for explanation. In the traditional teaching mode, compared with slides and 3D models, traditional drawing is easier to highlight the hierarchical and adjacent relationships of local human structures<sup>[3,4]</sup>. Therefore, how to use traditional drawing in the new teaching mode to help students deepen their memory and understanding of knowledge points and apply it in clinical case analysis is a key issue that the author has been exploring during the transition period of different teaching modes<sup>[5]</sup>.

The Xuexitong platform is a widely used online professional learning platform in the field of education. It is characterized by being accessible on mobile terminals such as smartphones and tablet computers, allowing students to learn without being restricted by time and place<sup>[6]</sup>. At present, most mainstream domestic educational institutions apply Xuexitong in teaching and learning during the pre-class and in-class periods, while the application of Xuexitong in after-class review is limited and the mode is single. After-class review is an important part of regional anatomy, and students' investment in after-class review greatly affects their learning outcomes. The author conducted a preliminary study on the application effect in the clinical medicine major of our university by using drawing assignments on the Xuexitong platform for after-class review of regional anatomy, aiming to retain the advantages of the traditional teaching mode and accumulate certain experience for the blended teaching mode in teaching practice<sup>[7]</sup>.

## **2. Research objects and methods**

### **2.1. Research objects**

Students from Groups 1–2 (28 students, experimental group) and Groups 3–4 (27 students, control group) of the 2022 clinical medicine major at Guangxi Medical University were selected as the research objects. There were no statistically significant differences in age or academic performance in previous anatomy-related courses between the two groups of students ( $P > 0.05$ ), indicating they were comparable<sup>[8]</sup>.

### **2.2. Teaching content**

The textbook used was Regional Anatomy (9th edition, People's Medical Publishing House) edited by Cui Huixian and Li Ruixi. The same teaching plan was implemented, including 30 class hours of theoretical teaching and 30 class hours of experimental teaching.

### **2.3. Teaching methods**

Both groups adopted an online-offline blended teaching mode based on the Erya platform. The teaching modes for the pre-class and in-class stages were the same for both groups. In the after-class stage, students in the control group were required to complete case analysis tasks in the "Discussion" section of Xuexitong, while students in the experimental group, in addition to case analysis, were assigned drawing tasks in the discussion section<sup>[9,10]</sup>.

### **2.4. Drawing assignment plan**

- (1) Scope of drawing: Key knowledge points such as local partitions, body surface projections, and important structures of each part;
- (2) The teacher of each class selects 1-2 pictures for explanation and draws them by hand with chalk on the blackboard;
- (3) Requirements for drawing: Colored pencils and electronic drawing are both acceptable, without being restricted to forms or creative methods;