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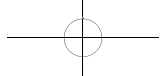
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## Education Reform and Development

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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.

*Education Reform and Development* mainly reflects the latest development and scientific research achievements of education, explores the rules of education, promotes academic exchanges at home and abroad, and serves for deepening educational reform and prospering educational science.

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# An Analysis of Ideological and Political-Professional Education Integration in Chinese Vocational Colleges: Precise Perspective

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**Abstract:** Taking the concept of “Precise Ideological and Political Education” as the core analytical framework, this paper first clarifies the inherent logical necessity of integration from three dimensions: epistemology, methodology, and axiology. Furthermore, on the basis of in-depth analysis of five practical barriers, “generalization of teaching content, rigidification of teaching methods, superficialization of practical teaching, ossification of evaluation mechanisms, and weakening of teachers’ motivation,” a systematic reform model including “goal layer - core layer - support layer” is constructed. In terms of practical paths, the model proposes to achieve “precision empowerment” through five core measures: “subject reconstruction, content reconstruction, method reconstruction, practice reconstruction, and evaluation reconstruction”: in terms of the support system, it emphasizes the need for four-wheel drive of “organizational coordination, institutional incentives, digital empowerment, and cultural infiltration” to ensure the sustainability and effectiveness of integration.

**Keywords:** Higher vocational colleges; Ideological and Political Theory Courses; Professional education; In-depth integration

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## 1. Introduction: The Era Proposition and Core Issues

Vocational education, as an educational type most closely linked to economic and social development, its talent training quality is directly related to the strength of national competitiveness. The report to the 20th National Congress of the Communist Party of China clearly proposes to “coordinate the collaborative innovation of vocational education, higher education, and continuing education, promote the integration of vocational and general education, industry-education integration, and science-education integration, and optimize the type positioning of vocational education.” Cultivating high-quality workers who not only master exquisite technical skills but also possess family and country feelings, professional ethics, and a sense of responsibility is the core



mission of higher vocational education in the new era. As a key course for China to implement the fundamental task of fostering virtue through education, Ideological and Political Theory Courses play an irreplaceable role in this mission.

However, a prominent practical contradiction exists: as a public basic course, the grand narrative system and universal value guidance of Ideological and Political Theory Courses have a certain tension with the highly specialized, concrete learning and life experience of higher vocational students oriented towards specific professional fields. At present, although the construction of “Curriculum Ideology and Politics” has achieved remarkable results at the professional course level, how Ideological and Political Theory Courses themselves can take the initiative to break the “isolated island” state and achieve “in-depth integration” rather than simple “superposition” with professional education remains a difficult and painful point in the reform. The so-called “in-depth integration” means that the teaching objectives, content, methods, practice, and evaluation of Ideological and Political Theory Courses are fully embedded in the professional talent training system, resonating with students’ professional identity, the formation of professional capabilities, and career development planning, so as to achieve a value shaping effect like “salt dissolving in water.” For a long time, the reform of Ideological and Political Theory Courses in higher vocational colleges has mostly focused on the optimization of internal elements, such as the innovation of teaching methods and the construction of teaching resources. Although certain results have been achieved, it has not fundamentally solved the problem of the mismatch between teaching supply and students’ needs. Students generally feel that the content of Ideological and Political Theory Courses is “high, empty, and abstract” and has little connection with their own majors, leading to insufficient learning motivation and greatly reduced teaching effectiveness. This “generalized” teaching model is essentially an extensive operation on the supply side.

Therefore, introducing the concept of “Precise Ideological and Political Education” to promote a profound supply-side structural reform in the teaching of Ideological and Political Theory Courses, realizing the transformation from “extensive irrigation” to “precision drip irrigation”<sup>[1]</sup>, has become an urgent era proposition. Beyond scattered strategic discussions, this paper aims to, from the perspective of systematic reform, first demonstrate the inherent logical necessity of the integration of Ideological and Political Theory Courses and professional education, then systematically diagnose the deep-seated difficulties currently faced, and finally construct a hierarchical and interlocking integrated path model of “goal - core – support,” hoping to provide theoretical support and practical guidance for the connotative development of Ideological and Political Theory Courses in higher vocational colleges in the new era.

## **2. The internal logic of integration: Three dimensions of inevitability**

The integration of Ideological and Political Theory Courses and professional education is not a forced grafting of policies, but stems from the inherent unity of the two in the essence of education, the laws of vocational education, and the requirements of the times. Its inevitability can be explained from three dimensions: epistemology, methodology, and axiology.

### **2.1. Epistemological dimension: The unity of knowledge imparting and value guidance**

Modern educational theory holds that any knowledge contains specific value orientations and cultural genes. The scientific and technological knowledge imparted by professional education is inherently value-neutral,

but its application scenarios, social consequences, and ethical boundaries are full of value judgments. The integration of Ideological and Political Theory Courses and professional education is precisely to reveal this internal connection, enabling students to deeply understand the significance of “why to live” while mastering the skills of “how to make a living”<sup>[2]</sup>. For example, when teaching programming technology, it is necessary to simultaneously discuss ethical issues such as data privacy and algorithmic fairness; when learning marketing, it is necessary to integrate value orientations such as honest operation and social responsibility. This integration breaks the separation between instrumental rationality and value rationality, conforms to the complete educational concept of “unity of knowledge and action, and simultaneous cultivation of morality and skills,” and is the unity of truth, goodness, and beauty in the process of knowledge construction.

## **2.2. Methodological dimension: The inherent requirement of “action-oriented” teaching in vocational education**

Vocational education emphasizes “action orientation,” allowing students to “learn by doing” and “do by learning.” If Ideological and Political Theory Courses are separated from students’ “action” field, namely professional learning and practice, they are likely to become empty preaching. Integrating ideological and political education into professional teaching links, such as project tasks, case analysis, and on-the-job internships, so that value guidance can be realized in the process of solving real and complex professional problems, is precisely the inherent requirement of the laws of vocational education<sup>[3]</sup>. The teamwork, rigor, pragmatism, and pursuit of excellence experienced by students in completing a technical project, handling a business case, or participating in a production process are far more profound and lasting than the cognition obtained in a purely theoretical classroom. Therefore, integration is the methodological cornerstone for improving the affinity and pertinence of Ideological and Political Theory Courses.

## **2.3. Axiological dimension: Strategic preparation for addressing future social challenges**

The world today is facing profound challenges from the technological revolution and industrial transformation. The development of artificial intelligence, biotechnology, and other fields has brought a series of ethical risks. The future society needs not only technical experts but also citizens who can control technology and have profound humanistic literacy and a strong sense of social responsibility. Higher vocational students are the backbone of the future industrial front line, and their value choices directly affect the direction of technological application. The in-depth integration of Ideological and Political Theory Courses and professional education aims to build a solid value “dike” for students in advance, cultivate their awareness of technological ethics, ecological concepts, and feelings of a community with a shared future for mankind, enabling them to distinguish right from wrong and abide by the bottom line on their future career paths. This is an important strategic investment to address future uncertainties and ensure healthy social development<sup>[4]</sup>.

## **3. Deep-seated practical difficulties: Systematic diagnosis from phenomenon to root cause**

Although the necessity of integration is obvious, the promotion of practice has been arduous. Its difficulties are systematic and need to be in-depth analyzed from all elements of teaching.

### **3.1. “Generalization” of teaching content: The “suspended” state from the professional field**

This is the core difficulty. The current textbook system of Ideological and Political Theory Courses is highly theoretical and universal. If teachers lack the awareness and ability of active transformation, the teaching content will be disconnected from students’ professional world. Using the same set of teaching plans and cases for almost all majors leads to the failure of teaching content to cut into the cognitive schema and emotional concerns formed by students based on their majors. This “suspended” state makes it difficult for the value discourse of Ideological and Political Theory Courses to be transformed into students’ conscious identification in the professional context, resulting in half the effort in teaching effect <sup>[5]</sup>.

### **3.2. “Rigidification” of teaching methods: The “mismatch” with professional thinking modes**

Higher vocational students are good at imagery thinking and practical thinking, and are accustomed to the learning mode of “task-driven” and “outcome-oriented.” However, the traditional teaching method of Ideological and Political Theory Courses still focuses on theoretical indoctrination and conclusion notification, which is “mismatched” with the thinking mode of vocational education. It has not effectively created professional-related simulated scenarios or real tasks, nor has it guided students to use professional thinking to deconstruct ideological and political issues, resulting in the failure of the teaching process to stimulate students’ in-depth cognitive investment and the value guidance remaining at a shallow level.

### **3.3. “Superficialization” of practical teaching: The “parallel” track with the professional training system**

Practical teaching of Ideological and Political Theory Courses (social surveys, volunteer services, etc.) and professional practical teaching (on-the-job internships, skill training) often belong to two “parallel” tracks in terms of goals, content, management, and evaluation, lacking intersection points <sup>[6]</sup>. During students’ internships in enterprises, their professional ethics performance and thinking on the social responsibility of the industry have not been effectively included in the observation and evaluation perspective of Ideological and Political Theory Courses. This phenomenon of “two skins” makes the professional practice link with the greatest educational potential fail to become an effective carrier of ideological and political education, wasting valuable educational resources.

### **3.4. “Ossification” of evaluation mechanisms: The “decoupling” from the growth of professional literacy**

The existing evaluation of Ideological and Political Theory Courses mainly focuses on the final knowledge-based assessment, which makes it difficult to measure the improvement of students’ internal values and the cultivation of professional spirit. The evaluation content is “decoupled” from professional literacy, and the evaluation subject is single (mainly Ideological and Political Theory Course teachers), which cannot reflect students’ ideological and political performance in professional learning and internship practice. This evaluation orientation makes both teachers and students lack sufficient motivation to further promote teaching integration, and the internal motivation for reform is insufficient.

### **3.5. “Weakening” of teachers’ motivation: The lack of “mechanisms” for interdisciplinary collaboration**

Ideological and Political Theory Course teachers generally face barriers in their knowledge structure and have

a limited understanding of non-social science majors. More importantly, there is a lack of stable and efficient interdisciplinary teaching and research mechanisms and incentive mechanisms<sup>[7]</sup>. There is a lack of regular communication platforms, cooperation projects, and corresponding achievement recognition methods between Ideological and Political Theory Course teachers and professional course teachers, leading to the “integration” remaining a spontaneous behavior of individual teachers and failing to form a scale effect and institutional achievements.

#### **4. Construction of systematic paths: An integrated model of “goal - core - support”**

In response to the above difficulties, scattered reforms that address symptoms rather than root causes are insufficient. It is necessary to carry out top-level design and systematic promotion.

##### **4.1. Goal layer: Precision empowerment, simultaneous cultivation of morality and skills**

The ultimate goal of systematic reform is to achieve “precision empowerment,” that is, through accurately docking with students’ professional development needs, the nutrients of ideological and political education are accurately dripped into the root system of students’ professional ability and personality growth, and finally output high-quality technical and skilled talents with “simultaneous cultivation of morality and skills.” This goal governs all reform measures.

##### **4.2. Core layer (Precision implementation): “Five-dimensional reconstruction” of all teaching elements**

This is the main part of the model, corresponding to five core elements in the teaching process.

###### **4.2.1. Subject reconstruction: From “isolated lecturer” to “professional-embedded navigator”**

- (1) Institutional Embedding: Establish a “professional contact person” system for Ideological and Political Theory Course teachers, where each teacher is fixedly linked to 1–2 professional groups, and regularly participates in their teaching and research activities, revision of talent training programs, academic lectures, and school-enterprise cooperation activities.
- (2) Role Diversification: Encourage Ideological and Political Theory Course teachers to serve as instructors of professional associations, “ideological and political mentors” for students’ scientific and technological innovation competitions, and team leaders for social practice activities such as “Going to the Countryside” (combined with professional services to society), establishing in-depth teacher-student relationships in real scenarios.
- (3) Development Community: Form “ideological and political-professional” integrated teaching teams with professional course teachers, jointly apply for teaching reform projects, develop teaching resources, and form a growth community with shared interests and responsibilities.

###### **4.2.2. Content reconstruction: From “general textbooks” to “professionalized teaching system”**

- (1) In-depth Student Situation Research: Use big data analysis, questionnaires, in-depth interviews, and other methods to continuously track the ideological dynamics, professional puzzles, and value cognition characteristics of students in different majors, and establish a “major-student situation” database.
- (2) Systematic Case Development: Cooperate with professional course teachers to jointly develop a



series of teaching cases with professional “flavor.” For example, for information technology majors, systematically develop case sets focusing on “technological ethics, network security, digital citizenship responsibility, and independent innovation in science and technology”: for intelligent manufacturing majors, systematically develop case sets focusing on “craftsmanship spirit, quality awareness, safe production, and innovative culture.”

- (3) Modular Resource Construction: Build the integrated content into a detachable and reconfigurable modular digital resource library (such as microcourses, case libraries, and question banks), embed it into the school’s online teaching platform for teachers to call on demand, and realize the dynamic update and sharing of resources.

#### **4.2.3. Method reconstruction: From “one-way indoctrination” to “situational interactive inquiry”**

- (1) Promote In-depth Case Teaching: Beyond illustrative explanations, adopt complex cases based on real professional dilemmas, guide students to conduct role-playing, debates, and write decision analysis reports, and learn to judge and choose in value conflicts.
- (2) Comprehensively Introduce Project-Based Learning (PBL): Design interdisciplinary comprehensive projects, such as “designing a marketing plan integrating e-commerce live streaming and rural revitalization narratives for local characteristic agricultural products,” allowing students to comprehensively use professional knowledge and ideological and political theories to solve practical problems in the whole process of completing the project.
- (3) Deepen the Integration of Information Technology: Use VR/AR technology to create highly simulated professional practice scenarios (such as virtual construction sites, simulated operating rooms, and simulated business negotiations), allowing students to understand professional ethics norms in an immersive experience. Use intelligent teaching tools to realize real-time classroom feedback and data-driven personalized guidance .

#### **4.2.4. Practice reconstruction: From “extracurricular activities” to “integrated educational field”**

- (1) Co-construction of Bases: Clearly include the “ideological and political education function” into the signing clauses of off-campus internship bases, and co-construct “ideological and political-professional” integrated practice bases with excellent cooperative enterprises.
- (2) Project Integration: In the professional on-the-job internship syllabus, clearly set up ideological and political practice links such as “professional ethics practice records” and “industry social observation reports,” which are jointly guided and assessed by enterprise mentors and ideological and political teachers.
- (3) Activity Co-creation: Cooperate with secondary colleges and the Youth League Committee to hold comprehensive competitions of “skill competitions + ideological and political literacy” and thematic educational activities with distinct professional characteristics, so that value guidance can be integrated into the blood of campus culture.

#### **4.2.5. Evaluation reconstruction: From “knowledge assessment” to “value-added-oriented comprehensive evaluation”**

- (1) Strengthen Process-Oriented and Performance-Oriented Evaluation: Significantly increase the weight of classroom discussions, project participation, and practical performance in the total evaluation score,

focusing on changes in students' value judgments, thinking qualities, and professional behaviors.

- (2) Establish a Value-Added Evaluation Model: Through the combination of entrance assessment and graduation assessment, track the growth value of students in the dimensions of ideological and political quality, professional spirit, and social responsibility, and scientifically evaluate the actual effect of teaching.
- (3) Implement Multi-Subject Evaluation: Incorporate the evaluations of professional course teachers, enterprise mentors, counselors, and even classmates on their relevant performance in professional learning and internship practice into the final evaluation of Ideological and Political Theory Courses according to a certain weight.
- (4) Reform Teacher Evaluation and Incentives: Take achievements such as participating in interdisciplinary teaching and research, developing integrated resources, and guiding integrated practice as important bases for the performance assessment, professional title evaluation, and selection of excellent Ideological and Political Theory Course teachers, forming a positive incentive loop.

### **4.3. Support layer (Precision guarantee): “Four-wheel drive” of integrated ecology**

The effective operation of the core layer requires a strong support system, namely “four-wheel drive.”

#### **4.3.1. Organizational coordination drive**

Establish a leading group for “ideological and political-professional” integration led by the main leaders of the school, with the participation of the Ideological and Political Theory Course department, Academic Affairs Office, Student Affairs Office, secondary colleges, School-Enterprise Cooperation Office, and other departments. Set up a special office responsible for top-level design, overall coordination, resource allocation, and conflict resolution.

#### **4.3.2. Institutional incentive drive**

Formulate a series of systems such as the “Implementation Plan for the In-depth Integration of Ideological and Political Theory Courses and Professional Education,” “Measures for the Construction and Management of Interdisciplinary Teaching Teams,” and “Measures for the Recognition and Reward of Integrated Teaching Achievements,” clarify the rights, responsibilities, and interests of all parties, and provide stable institutional expectations for integrated reform.

#### **4.3.3. Digital platform drive**

Build an “intelligent ideological and political-professional integration” digital platform, integrate student situation data, integrated teaching resources, support cross-time and space teaching and research activities, realize the management of teaching processes and the monitoring of effects, and provide technical support for precise teaching and management decisions.

#### **4.3.4. Cultural infiltration drive**

Create a good campus cultural atmosphere that encourages innovation, tolerates failure, and promotes collaborative education by publicizing excellent integrated cases, selecting and commending advanced teams and individuals, and holding integrated teaching salons, so that integration becomes a value consensus and conscious action of the whole school.

## 5. Conclusion

Promoting the in-depth integration of Ideological and Political Theory Courses and professional education is a systematic project involving conceptual renewal, system reconstruction, and motivation stimulation, which cannot be achieved overnight<sup>[8]</sup>. The “goal - core - support” model proposed in this paper attempts to provide an overall framework from macro to micro and from concept to operation. Its successful implementation lies in the strategic determination and top-level design at the school level, the core is to build a collaborative mechanism for the shared destiny of Ideological and Political Theory Course teachers and professional course teachers, and the difficulty is to break the inherent departmental barriers and evaluation inertia. Looking forward to the future, this reform needs to be continuously deepened in the following aspects: first, strengthen empirical research, test the effectiveness of different paths through rigorous action research and big data tracking, and continuously optimize the model: second, pay attention to the depth of technological empowerment, and explore the application of artificial intelligence in personalized student situation analysis, resource push, and effect evaluation: third, expand the international perspective, conduct comparative research on the value guidance models in vocational education in developed countries, and draw on their essence. Finally, through persistent efforts, make Ideological and Political Theory Courses truly become courses that higher vocational students truly love, benefit from lifelong, and remember for a lifetime, and cultivate more era newcomers with exquisite skills and soul light for the construction of a powerful country.

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# Research on the Teaching Reform Paths of Business English in Colleges and Universities Under the Background of the New Liberal Arts

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**Abstract:** Under the background of the comprehensive advancement of the new liberal arts construction, the teaching of Business English in colleges and universities has gained greater development space. Colleges and universities need to seize the opportunity of the times, align with market demand, adapt to national strategies, and realize the transformation and upgrading of the discipline. Combined with the core characteristics of the new liberal arts, strategic nature, innovation, integration, and development, this paper analyzes the prominent problems existing in the current Business English teaching in colleges and universities, and explores the practical paths of teaching reform under the background of the new liberal arts. It aims to promote the reform of Business English teaching and cultivate compound Business English talents.

**Keywords:** New liberal arts; College business English; Teaching reform; Compound talents

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## 1. Introduction

The new liberal arts advocates the reorganization of traditional humanities, promotes the interdisciplinary integration of liberal arts and sciences, and integrates new technological elements to cultivate comprehensive, interdisciplinary, and diversified innovative talents in the new era. Under the upsurge of interdisciplinary integration in the field of education, cultivating compound talents has become the core goal of the Business English major. How to make good use of the opportunity of the new liberal arts construction, based on the actual teaching situation of the university, explore scientific and feasible reform paths, and improve the quality and efficiency of teaching has become a key issue that needs to be studied urgently under the current situation.

## **2. The contemporary logic of business English teaching reform in colleges and universities under the background of the new liberal arts**

### **2.1. The connotation and core characteristics of the new liberal arts**

The new liberal arts is an educational development concept proposed to respond to the complex domestic and international situation, enhance international discourse power, and promote the deepening reform of the economy and society after socialism with Chinese characteristics has entered a new era. Its core lies in the disciplinary reorganization of traditional humanities and social sciences, upgrading its connotation, and building a liberal arts education system adapting to the needs of the new era<sup>[1]</sup>. The new liberal arts has distinct contemporary characteristics, mainly in the following four aspects: first, strategic nature. Its purpose is to strengthen talent strategic training and serve the overall situation of national opening up and economic development; second, innovation. Through reforming the traditional training model, achieve breakthroughs in theory, mechanism, and model, and promote the transformation of traditional disciplines; third, integration. Break disciplinary barriers and promote the interdisciplinary integration of liberal arts and sciences, liberal arts and engineering, liberal arts and medicine, etc.; fourth, development. Society is in constant development and change, and there will be uncertainties in the field of humanities and social sciences. It is necessary to adjust and improve the “new liberal arts” in the process of development.

These characteristics of the “new liberal arts” provide a clear direction for the teaching reform of Business English in colleges and universities. It needs to break the single disciplinary framework and realize the transformation from knowledge impartment to ability training, and from closed teaching to open education.

### **2.2. The inherent compatibility between business English and the new liberal arts**

Business English is an interdisciplinary and applied discipline aiming at cultivating English language skills and business communication skills. It covers a wide range of fields and is an integration product of business disciplines such as economics, management, and trade. With the rapid changes in the market economy and the deepening of global cooperation, Business English places more on cultivating compound talents with solid language skills, business knowledge, and strong practical ability<sup>[2]</sup>. Both in terms of disciplinary attributes and talent training goals, Business English has a strong compatibility with the “new liberal arts” concept. The construction of the new liberal arts is a solid background for the cultivation of compound Business English talents, and the reform of Business English talent training is a specific manifestation of the implementation of the new liberal arts concept. The two are integrated and interrelated, and jointly cultivate talents.

### **2.3. Policy basis and practical needs for teaching reform**

At the policy level, the “Belt and Road” initiative and the “dual circulation” strategy clearly require the cultivation of business talents who are familiar with international rules. The construction of the new liberal arts by the Ministry of Education advocates interdisciplinary integration, and the “Guidelines for the Teaching of Undergraduate Business English Majors in Regular Institutions of Higher Education” incorporates cross-cultural competence and critical thinking ability into the talent training goals. At the practical level, the development of economic globalization and the digital economy has given birth to new formats such as cross-border e-commerce, international business negotiations, and digital trade, putting forward higher requirements for the comprehensive ability of Business English talents. However, the current Business English teaching in some colleges and universities is facing problems such as the mismatch between talent training supply and demand, and the disconnection between practical teaching and the industry, which makes it difficult to meet

the needs of the new era for compound talents<sup>[3]</sup>. The superposition of this policy orientation and practical contradictions makes the transformation of Business English teaching towards an interdisciplinary and applied nature inevitable.

### **3. Prominent problems existing in the current business English teaching in colleges and universities**

#### **3.1. Vague orientation of teaching goals, disconnected from the requirements of the new liberal arts**

The teaching of Business English in colleges and universities overemphasizes the mastery of basic theories of English language, but lacks education on business communication and business etiquette, and ignores the cultivation of students' language application ability and cross-cultural competence, making it difficult to adapt to real business work scenarios<sup>[4]</sup>. In addition, the orientation of talent training goals is vague, failing to reflect the needs of interdisciplinary integration, and lacking the integration of interdisciplinary knowledge, such as economics, management, and digital technology. The cultivated talents are difficult to cope with complex business environments.

#### **3.2. Unbalanced curriculum system, insufficient interdisciplinary integration**

The current curriculum system of Business English in colleges and universities is unreasonably structured. Most of the compulsory courses are language basic courses and business theory courses, with fewer practical courses and single content. In addition, the interdisciplinary integration of courses is insufficient. The curriculum setting fails to incorporate cutting-edge content under the background of the new liberal arts, such as the digital economy, artificial intelligence, and cross-border trade rules, and also lacks interdisciplinary courses related to finance, management and other related disciplines, making it difficult to meet the needs of students' personalized development and career planning<sup>[5]</sup>.

#### **3.3. Traditional and single teaching methods, low degree of technology integration**

The traditional teacher-centered lecture-based teaching still dominates the teaching, ignoring the dominant position of students, and lacking interactivity and innovation. Especially with the continuous development of emerging technologies, the integration of artificial intelligence, virtual reality, online learning platforms, etc., in the field of education has become inevitable<sup>[6]</sup>. However, some teachers have insufficient ability to apply emerging teaching technologies and methods in the teaching process, and the teaching methods are single and backward, making it difficult to stimulate students' learning interest.

#### **3.4. Weak practical teaching links, imperfect school-enterprise collaboration mechanism**

Practice makes perfect. To improve students' business communication level and ability, it is urgent to improve the corresponding practical teaching system in combination with the actual needs of Business English curriculum teaching. However, the current lack of practical resources, backward construction of training bases, and disconnection between practical content and actual job needs are all key factors restricting the quality of practical teaching<sup>[7]</sup>. Some colleges and universities lack high-standard facilities such as business simulation laboratories and digital trade training platforms on campus, and the construction of off-campus practice bases is backward. School-enterprise cooperation is mostly a formality, and students' practical ability is difficult to

be effectively improved.

## **4. Practical paths of business English teaching reform in colleges and universities under the background of the new liberal arts**

### **4.1. Reconstruct the curriculum system and optimize the curriculum content setting**

Under the background of the new liberal arts, the reconstruction of the Business English curriculum system needs to be based on the university's positioning, closely linked to industry development needs and local economic development goals. The curriculum setting should reflect the characteristics of applicability, career orientation, and openness, and improve students' professional ability<sup>[8]</sup>. Under the professional curriculum model of "language tools + business skills" in Business English, combined with the new liberal arts concept, we should blur the boundary between professional theoretical courses and practical courses, and reflect the changing trend of practice in theoretical courses and strong theory in practical courses in the construction of the curriculum system. Derive and develop practical courses such as comprehensive international trade training, foreign trade follow-up practice, and cross-border e-commerce training from traditional Business English professional courses such as international trade practice and international marketing, and appropriately increase the proportion and weight of practical courses. Carry out school-enterprise cooperation with local foreign trade enterprises, invite enterprise backbones and industry experts to serve as training instructors, extend the classroom to enterprises, provide students with real job practice opportunities, and improve their professional quality. At the same time, adhering to the concept of keeping pace with the times, optimize and innovate the traditional curriculum content, supplement the latest Business English vocabulary and industry cases, replace outdated content, reduce the explanation of pure language knowledge, and reserve more practical space for students<sup>[9]</sup>.

### **4.2. Innovate teaching methods and create immersive and interactive experiences**

The innovation of teaching methods is the key to improving teaching effect. It is necessary to break the traditional teaching model and build an interactive, immersive, and personalized teaching model.

First, implement situational teaching method, simulate real business scenarios such as business negotiations, product promotion, and cross-border e-commerce operations, let students play different roles in the scenarios, use English to complete business communication and practical tasks, and improve their language application ability and business skills. Second, adopt a project-based teaching method, take real business projects as carriers, and cultivate students' teamwork ability, innovation ability, and problem-solving ability.

Third, build a mixed teaching model that integrates the advantages of online and offline teaching: online, use platforms such as MOOC and Xuexitong to provide high-quality teaching resources for students to learn independently, carry out personalized learning and interactive communication; offline, focus on practical training, case analysis, group discussions and other links to realize the organic combination of online and offline teaching<sup>[10]</sup>.

Fourth, introduce new technologies to empower teaching. Teachers can use artificial intelligence technology to help students improve their pronunciation and oral expression ability; use virtual reality (VR) technology to build immersive business scenarios, allowing students to obtain an immersive learning experience; use big data technology to analyze students' learning data, grasp students' learning difficulties and



advantages, and provide personalized teaching guidance.

#### **4.3. Deepen school-enterprise collaboration and establish a long-term and in-depth cooperation mechanism**

School-enterprise collaboration is an important way to realize practical talent training. Colleges and universities should break the long-standing dilemma of superficial school-enterprise cooperation and establish a long-term and in-depth cooperation mechanism. First, establish a school-enterprise co-construction and benefit-sharing cooperation mechanism, and clarify the respective rights and obligations of colleges and universities and enterprises. Colleges and universities need to provide talent support and scientific research services for enterprises, while enterprises should provide practical positions, practical teachers, real projects and other resources for schools, so as to achieve mutual benefit and win-win results<sup>[11]</sup>. Schools and enterprises can also co-construct on-campus training bases and off-campus internship bases. On-campus bases introduce real operation platforms and equipment of enterprises, and off-campus bases provide on-the-job internship positions for students to ensure that practical teaching meets the needs of actual positions.

In addition, schools and enterprises need to cooperate in formulating talent training programs, designing curriculum content and assessment standards. Enterprises should participate in the whole teaching process, send industry experts to serve as part-time teachers, guide practical teaching and graduation design, and improve the quality of talent training<sup>[12]</sup>. At the same time, carry out industry-university-research cooperation, and schools and enterprises jointly carry out research on Business English-related topics and project development activities, transform scientific research achievements into teaching resources, and improve the cutting-edge and practicality of teaching.

#### **4.4. Strengthen teacher team construction and cultivate a compound and professional teacher team**

The construction of a teacher team is the fundamental guarantee for teaching reform. It is necessary to cultivate a compound and professional Business English teacher team in accordance with the requirements of the new liberal arts for teachers. Colleges and universities should optimize the standards for teacher recruitment, pay attention to their interdisciplinary background and industry practical experience when recruiting teachers, and absorb compound talents with English language ability, business professional knowledge, and industry practical experience to join the teacher team. At the same time, invite outstanding practitioners from enterprises to serve as part-time teachers to optimize the structure of the teacher team<sup>[13]</sup>.

For in-service teachers, colleges and universities also need to strengthen training, organize teachers to participate in academic exchanges, industry practices and other activities, learn advanced teaching concepts and methods, and improve teachers' interdisciplinary literacy, technology application ability, and practical teaching ability. At the same time, encourage teachers to take on temporary positions in enterprises to have a deeper understanding of industry development and the talent needs of actual industry positions, thereby improving teaching effects<sup>[14]</sup>. In addition, colleges and universities should build an interdisciplinary exchange and cooperation platform for teachers, set up on-campus interdisciplinary teaching and research teams, promote the exchange and cooperation between teachers of language disciplines, business disciplines, information technology disciplines, etc., and carry out interdisciplinary teaching.

#### **4.5. Optimize the evaluation system and establish a compound talent evaluation mechanism**

First, improve evaluation indicators. The cultivation of compound Business English talents based on the new liberal arts should focus on multiple levels. Therefore, colleges and universities should consider students' language ability, business negotiation skills, cross-cultural literacy, etc., as evaluation indicators, and pay attention to students' all-round development. At the same time, increase the weight of indicators such as practical ability and innovative achievements to highlight the orientation of practical talent training<sup>[15]</sup>. Second, it is necessary to enrich evaluation methods, adopt a combination of process evaluation and summative evaluation, and use methods such as business case analysis, practical operation assessment, and business competitions as evaluation tools to comprehensively reflect students' comprehensive abilities. Finally, colleges and universities need to expand the evaluation subjects. In addition to teacher evaluation and student self-evaluation, external evaluation should be added, and Business English industry experts, enterprise representatives, etc. should be invited to participate in the evaluation to make a more comprehensive and objective evaluation of students. Colleges and universities need to optimize the Business English talent evaluation system according to the actual situation to make it more adaptable to the development needs of the new liberal arts era.

### **5. Conclusion**

The construction of the new liberal arts provides an important opportunity and puts forward higher requirements for the teaching reform of Business English in colleges and universities. The teaching reform of Business English in colleges and universities needs to be based on the contemporary characteristics and core requirements of the new liberal arts, closely linked to market demand and talent training goals, and promote collaboratively from multiple dimensions such as curriculum system, teaching methods, and school-enterprise collaboration, so as to cultivate more compound Business English talents for national opening up and economic and social development.

### **Disclosure statement**

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# Analysis of Countermeasures for the Construction of an Integrated Curriculum System for the Chemical Technology Major in Secondary Vocational Schools

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**Abstract:** Currently, the social market has increasingly high requirements for the capabilities and qualities of chemical industry professionals. Against the backdrop of the new round of educational reform, secondary vocational schools, as an important base for cultivating chemical technology professionals, can effectively break the separation between traditional theoretical teaching and practical teaching by strengthening the construction of an integrated curriculum system, which is conducive to promoting the in-depth integration of “teaching, learning, and doing”. Therefore, this paper mainly analyzes and studies the significance, problems, principles, and countermeasures of constructing an integrated curriculum system for the chemical technology major in secondary vocational schools, aiming to cultivate a group of chemical technology professionals more in line with the current employment market demand, and hoping to provide some reference for peers.

**Keywords:** Secondary vocational schools; Chemical technology major; Integration; Curriculum system; Construction countermeasures

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## 1. Introduction

In the new era, as a pillar industry of the national economy, the chemical industry is gradually transforming and upgrading from a traditional labor-intensive industry to a technology-intensive and knowledge-intensive one<sup>[1]</sup>. Especially with the continuous rise of emerging fields such as the green chemical industry, the fine chemical industry, and intelligent production, the chemical industry has put forward higher new requirements for the comprehensive quality and capabilities of front-line technical and skilled talents. As the core educational carrier connecting the talent supply of the chemical industry, the quality of talent training in the chemical technology major of secondary vocational schools is closely related to the transformation, upgrading, and future development of the chemical industry. However, the construction of the curriculum system for the chemical technology major in some secondary vocational schools currently has an obvious phenomenon of separation between “theory



and practice”, resulting in students’ difficulty in applying the learned knowledge and skills to practice, and it is difficult to ensure that they meet the actual needs of modern chemical production. By constructing an integrated curriculum system, we can effectively promote the “integration of teaching, learning, and doing”, help break the boundary between theoretical teaching and practical teaching, and promote the coordinated development of students’ knowledge and skills <sup>[2]</sup>. Therefore, as a teacher of the chemical technology major in secondary vocational schools in the new era, it is necessary to attach importance to the construction of an integrated curriculum system to better assist students’ learning and development.

## **2. Significance of constructing an integrated curriculum system for the chemical technology major in secondary vocational schools**

### **2.1. Meeting the industry’s demand for technical and skilled talents**

In recent years, with the continuous development of emerging fields such as the green chemical industry and the fine chemical industry, the chemical industry, as a pillar industry of the national economy, has also begun to put forward higher new requirements for the practical operation ability, problem-solving ability, and comprehensive quality of front-line technical personnel. However, in the traditional curriculum system of chemical technology in secondary vocational schools, theoretical teaching and practical operation usually belong to different links, and there is a certain disconnection between them, which easily leads to the problem that students “understand theory but cannot apply it.” By constructing an integrated curriculum system, we can realize the organic integration of theoretical knowledge and practical training, transform real tasks in chemical production into specific teaching content, and enable students to gradually master relevant theoretical principles and practical operation skills in the process of completing tasks. This is conducive to cultivating “plug-and-play” talents more in line with the job requirements of the chemical industry, thereby effectively alleviating the shortage of skilled talents in the chemical industry <sup>[3]</sup>.

### **2.2. Implementing the type orientation and educational goals of secondary vocational education**

Essentially, secondary vocational education is vocational education, emphasizing “competency-based”, and its main purpose is to cultivate high-quality technical and skilled talents <sup>[4]</sup>. The construction of an integrated curriculum system requires teachers to abandon the traditional one-sided teaching mode of “valuing theory over practice”, adhere to the cultivation of students’ vocational ability as the basic orientation, and reconstruct and optimize the curriculum content and teaching process. Specifically for the chemical technology major, teachers can organically combine chemical principles, chemical processes, equipment operation, and other contents with production practice, allowing students to gradually deepen their understanding and cognition of professional knowledge in specific practices, and gradually improve their professional practical skills in solving practical problems, which is of great significance for students’ future career development.

### **2.3. Improving students’ comprehensive quality and employment competitiveness**

At present, the demand and requirements of the chemical industry employment market for talents are no longer limited to a single operational ability, but tend to employ professional talents with high comprehensive quality and ability. Carrying out teaching based on an integrated curriculum system allows teachers to not only attach importance to the training of students’ professional practical skills but also pay attention to the cultivation of

students' vocational literacy, innovative thinking, and teamwork ability. In this way, students can not only master a solid professional theoretical foundation and practical operation skills but also have good vocational literacy, which is of great significance for improving their employment competitiveness<sup>[5]</sup>.

### **3. Problems existing in the construction of an integrated curriculum system for the chemical technology major in secondary vocational schools**

#### **3.1. Disconnection between curriculum content and job requirements**

At present, the construction of the integrated curriculum system for the chemical technology major in some secondary vocational schools has not conducted in-depth research in enterprises, nor has it fully analyzed the actual needs of positions. This easily leads to the disconnection between the content setting of the curriculum system and the actual job requirements, resulting in the lack of practicality of the knowledge and skills learned by students.

#### **3.2. Lagging construction of a “dual-qualified” teacher team**

The construction of an integrated curriculum system for the chemical technology major in secondary vocational schools requires a “dual-qualified” teacher team as support and guarantee. Generally speaking, such teachers need to have solid theoretical knowledge of chemical technology and rich practical experience in chemical production. Only in this way can they organically combine theoretical teaching with practical guidance, thereby providing students with better teaching services. However, at present, the construction of the “dual-qualified” teacher team for the chemical technology major in many secondary vocational schools still has some problems, which to a certain extent restricts the construction process of the integrated curriculum system. Specifically, it is manifested in the following two aspects: first, some teachers are directly employed as college graduates and lack work practice experience in front-line enterprises, resulting in their relatively low practical guidance ability<sup>[6]</sup>. Second, although some teachers have certain practical work experience in enterprises, they lack systematic educational and teaching theoretical support, making it difficult to design scientific and effective integrated teaching activities.

### **4. Principles for constructing an integrated curriculum system for the chemical technology major in secondary vocational schools**

#### **4.1. Guided by vocational competence**

When constructing an integrated curriculum system for the chemical technology major, secondary vocational schools need to adhere to the orientation of vocational competence, ensuring that the curriculum content and the development of teaching activities are always carried out around the vocational competence requirements of core positions in the chemical industry. Only in this way can a solid foundation be laid for students' future employment and career development. Specifically, before construction, secondary vocational schools can further clarify the professional skills (such as reactor operation, process regulation, product testing, etc.), theoretical knowledge (such as chemical thermodynamics, chemical kinetics, process calculation, etc.), and vocational literacy (such as safety awareness, sense of responsibility, standardized operation habits, etc.) required for core positions such as chemical operators, process controllers, and quality inspectors through enterprise research, job analysis, and other measures. Then, based on this, they can be transformed into specific curriculum goals and teaching modules, thereby ensuring that the construction of the curriculum system is always highly consistent

with the actual requirements of job capabilities in the chemical industry <sup>[7]</sup>.

## **4.2. Integration of theory and practice**

Essentially, the construction of an integrated curriculum system is the in-depth integration of theory and practice, emphasizing the need to break the traditional pattern of separated theoretical and practical teaching. In curriculum design, secondary vocational schools need to decompose abstract chemical technology theoretical knowledge into several specific practical tasks, allowing theoretical teaching to serve students' practical operations, so that students can gradually deepen their understanding and cognition of professional theoretical knowledge in specific practical operations, and ultimately achieve the goal of enabling students to "learn by doing and do by learning" <sup>[8]</sup>.

## **4.3. Combination of practicality and forward-looking**

When constructing an integrated curriculum system for the chemical technology major, secondary vocational schools also need to consider its practicality and forward-looking. On the one hand, practicality requires that the content design of the curriculum system should be closely aligned with the actual needs of current chemical production, focusing on mainstream industry technologies and equipment. Its main purpose is to ensure that the professional knowledge and skills learned by students can be directly applied to job practice <sup>[9]</sup>. On the other hand, forward-looking requires that the construction of the curriculum system should pay more attention to the development trends of the chemical industry, such as the application of green chemical technology and intelligent production equipment, and appropriately integrate relevant cutting-edge knowledge and skills. Its main purpose is to avoid the curriculum content lagging behind the industry development and effectively cultivate students' ability to adapt to the future development of the industry <sup>[10]</sup>.

# **5. Countermeasures for constructing an integrated curriculum system for the chemical technology major in secondary vocational schools**

## **5.1. Deepening the integration of production and education and reconstructing the curriculum content system**

To ensure the construction effect of the integrated curriculum system for the chemical technology major, it is necessary for secondary vocational schools to further deepen the integration of production and education, strengthen the optimization and reconstruction of the curriculum content system, and ensure the accurate connection between curriculum content and job requirements. On the one hand, the school can set up a curriculum development team composed of college teachers, enterprise technical backbones, and industry experts. Through on-site research, job competency analysis, and other measures, the competency requirements of each core position can be further clarified and transformed into specific curriculum modules and learning tasks <sup>[11]</sup>. For example, for the position of chemical operator, the school can develop core modules such as chemical equipment operation and maintenance, process regulation, and set up specific learning tasks such as centrifugal pump operation and reactor parameter adjustment under each module to better ensure the learning effect of students. On the other hand, the school can establish a sound dynamic update mechanism for curriculum content, regularly invite enterprise experts to participate in curriculum seminars, and timely integrate new industry technologies, processes, and specifications into the curriculum content system, thereby effectively ensuring the practicality and forward-looking of the curriculum <sup>[12]</sup>.

## 5.2. Strengthening teacher training and building a “dual-qualified” teacher team

A “dual-qualified” teacher team is the core guarantee for the implementation of the integrated curriculum system. To this end, secondary vocational schools can take the following measures to build a “dual-qualified” teacher team with strong comprehensive capabilities: first, improve the teacher training mechanism. For example, teachers can be regularly organized to take on temporary positions in cooperative enterprises to actively participate in enterprise production practice and accumulate practical experience. At the same time, regular teaching ability training can be carried out to further improve teachers’ ability in integrated teaching design and implementation<sup>[13]</sup>. Second, increase the intensity of talent introduction, and actively recruit technical backbones with rich front-line work experience from enterprises to continuously optimize the structure of the teacher team. Third, establish a sound incentive mechanism, link the identification of “dual-qualified” teachers with professional title evaluation and performance appraisal, encourage teachers to take the initiative to improve their “dual-qualified” abilities, and thus form a new pattern of teacher training featuring “teaching benefits teachers and students alike, and school-enterprise integration”<sup>[14]</sup>.

## 5.3. Improving teaching resources to support the development of integrated teaching

In practice, secondary vocational schools also need to strengthen the construction of teaching resources to provide sufficient hardware and software support for integrated teaching. On the one hand, in terms of hardware, the school needs to increase capital investment, actively build a comprehensive training base integrating theoretical teaching areas, practical training areas, and simulation areas, and equip it with training equipment synchronized with enterprises. At the same time, it can introduce chemical production simulation software and build a virtual training platform to effectively make up for the shortcomings of high risk and high cost in real equipment operation<sup>[15]</sup>. On the other hand, in terms of software, the school can organize teachers and enterprise technical personnel to jointly compile integrated textbooks, integrating theoretical knowledge, operation steps, safety specifications, and other contents into the textbooks. At the same time, it is necessary to establish an integrated teaching resource library and actively integrate microcourses, teaching videos, practical cases, and other resources to provide more support and guarantee for students’ independent learning.

## 6. Conclusion

In a word, strengthening the construction of an integrated curriculum system for the chemical technology major in secondary vocational schools can better adapt to the development needs of the chemical industry and greatly improve the quality of talent training in schools. In specific practice, secondary vocational schools can realize the construction of an integrated curriculum system for the chemical technology major through various measures such as deepening the integration of production and education, reconstructing the curriculum content system; strengthening teacher training, building a “dual-qualified” teacher team; and improving teaching resources to support the development of integrated teaching, thereby cultivating more high-quality professional technical and skilled talents for the chemical industry.

## Disclosure statement

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# Analysis of the Application Countermeasures of Virtual Simulation Technology in Practical Teaching of Chemical Technology Majors in Secondary Vocational Schools

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**Abstract:** In the practical teaching of chemical technology majors in secondary vocational schools, more and more teachers have begun to apply virtual simulation technology. This digital technology not only provides a safe, practical environment for teaching activities but also breaks the limitations of time and space, allowing students to repeatedly practice complex processes. Based on this, this paper briefly analyzes the application value of virtual simulation technology in the practical teaching of chemical technology majors in secondary vocational schools and the current situation of practical teaching of these majors. It also explores the effective application of virtual simulation technology in practical teaching from aspects such as teaching resources, teaching system, teaching mode, and teacher team construction.

**Keywords:** Virtual simulation technology; Chemical technology majors; Practical teaching

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## 1. Introduction

In recent years, the transformation and upgrading of China's chemical industry have accelerated, and the application of digital technology in the chemical industry has become increasingly in-depth. Secondary vocational schools should also keep pace with the times by applying information-based teaching methods such as virtual simulation technology to further improve the quality of practical teaching of chemical technology majors, overcome the limitations of outdated training equipment, limited training venues, and high safety risks in traditional teaching, provide students with more diverse and effective practical learning experiences, and enhance their practical abilities in chemical technology.

## **2. Application value of virtual simulation technology in the practical teaching of chemical technology majors in secondary vocational schools**

### **2.1. Improving the safety of practical teaching**

Conventional practical teaching of chemical technology majors in secondary vocational schools requires completing chemical preparation, instrument operation, and verifying complex chemical unit reactions such as nitration, chlorination, and polymerization through experiments, all of which involve certain safety risks. For example, if students operate high-pressure reactors incorrectly, safety accidents such as poisoning, explosion, and corrosion may occur, threatening the lives of teachers and students <sup>[1]</sup>. Therefore, for safety reasons, many secondary vocational schools usually cancel or simplify high-risk experimental training in the practical teaching of chemical technology majors. Virtual simulation technology, however, can provide students with a virtual, risk-free practical environment. Breaking the time and space constraints of previous practical teaching, students can repeatedly practice the operation of complex processes and long-cycle workflows in the practical teaching of chemical technology majors, as well as experimental training that is difficult to realize in reality, effectively expanding the depth and breadth of practical teaching.

### **2.2. Innovating practical teaching processes and methods**

Teacher demonstration and student imitation are the most common teaching methods in the practical teaching of chemical technology majors in secondary vocational schools. Students often “cannot see or touch” teaching difficulties during practice and are in a passive learning state. In this regard, teachers can apply virtual simulation technology in teaching to design high-simulation scenarios and interactive tasks for students, transforming them from passive listeners to active explorers. In virtual scenarios, students can “experience” operating equipment and adjusting parameters in real workshops, which can effectively improve their concentration during practice, promote the application of theoretical knowledge to practice, and thus deepen their understanding of professional knowledge <sup>[2]</sup>. In addition, virtual simulation systems can set practical tasks and work scenarios of different difficulties to meet the learning needs of students at different levels, providing them with targeted and personalized learning experiences.

### **2.3. Strengthening the integration of production and education in practical teaching**

Cultivating high-quality vocational and technical talents who meet the needs of industrial positions is the core goal of secondary vocational education. The use of virtual simulation technology in the practical teaching of chemical technology majors in secondary vocational schools can effectively connect practical teaching with job work, building a bridge between secondary vocational schools and chemical enterprises. Secondary vocational schools can cooperate with chemical enterprises and virtual simulation system development enterprises to jointly develop virtual practical projects for chemical technology majors based on the real production processes, equipment models, and operating specifications of enterprises. This allows students to simulate real job operations in chemical enterprises through online platforms, familiarize themselves with enterprise production processes and job skill requirements in advance, and accumulate “job experience” without going to the front line of enterprises <sup>[3]</sup>. At the same time, through cooperation with chemical enterprises, teachers of chemical technology majors in secondary vocational schools can also learn about the latest industry trends and technological developments, integrate them into practical teaching, and promote the innovative development of the integration of production and education in practical teaching.

### **3. Current situation of practical teaching of chemical technology majors in secondary vocational schools**

#### **3.1. High loss and cost of teaching resources**

Practical teaching of chemical technology majors in secondary vocational schools requires the use of large-scale precision equipment such as distillation columns and centrifugal compressors. The purchase and maintenance of this equipment require huge financial support. Moreover, if students damage the equipment due to incorrect operation during practice, it is easy to incur high maintenance costs. The high cost makes it difficult for many secondary vocational schools to carry out high-frequency practical teaching <sup>[4]</sup>. For this reason, the content of practical teaching of chemical technology majors in secondary vocational schools is very limited, and students can only conduct practical operations on low-value basic equipment. In addition, some secondary vocational schools have limited teaching resources, and the number of existing equipment and class hour arrangements is difficult to meet students' practical training needs. Even some complex chemical experiments can only be operated by students once or twice. The limited number of practices is not conducive to students forming stable professional skills, nor is it easy to improve their practical operation level.

#### **3.2. Disconnection between teaching content and job requirements**

At present, the practical teaching content of some chemical technology majors in secondary vocational schools has the problem of “valuing tradition over innovation” and is disconnected from the actual work content of chemical positions. On the one hand, the current practical teaching content of chemical technology majors in secondary vocational schools lacks job relevance, focusing more on the training of basic operations such as distillation, purification, filtration, separation, and chemical instruments. It does not pay enough attention to the abilities widely used in enterprise operations, such as DCS operation control, quality control analysis and interpretation of chemical plant areas, production line adjustment, routine maintenance and troubleshooting of machinery, etc. As a result, after students enter enterprises, they need to re-learn these contents before they can carry out their work <sup>[5]</sup>. On the other hand, the practical teaching content ignores the integration of the development trends of the chemical industry and does not fully cover modern chemical concepts such as green chemical industry, safe chemical industry, and intelligent chemical industry, thus failing to meet the demand of chemical enterprises for compound chemical vocational and technical talents.

#### **3.3. Relatively weak “dual-qualified” teacher team**

At present, most teachers of chemical technology majors in secondary vocational schools are masters and doctors from university chemical majors. Although they have solid theoretical knowledge, they generally lack front-line work experience in chemical enterprises. They do not have an in-depth grasp of knowledge related to the operation of actual chemical production, facility maintenance plans, process improvement plans, safety management, etc. Therefore, when guiding students' practice, it is easy for students to feel “generalized”, and it is difficult to interpret operating principles in combination with industrial reality <sup>[6]</sup>. At the same time, the insufficient introduction of enterprise tutors is also one of the factors affecting the construction of teachers in chemical technology majors in secondary vocational schools. Chemical enterprises are unwilling to allow core technical personnel to participate in teaching for a long time. Even if they participate, it is mostly in the form of special lectures, making it difficult to deeply integrate into the entire process of practical curriculum design, training guidance, and skill assessment <sup>[7]</sup>. In addition, teacher training in secondary vocational schools mainly focuses on theoretical improvement, with less systematic training on chemical practical experience and new



process technologies, resulting in teachers' practical teaching ability being unable to keep up with the pace of industrial technological updates.

#### **4. Application countermeasures of virtual simulation technology in practical teaching of chemical technology majors in secondary vocational schools**

##### **4.1. Optimizing teaching resources based on virtual simulation practical teaching platforms**

In the internet era, more and more teachers have realized the importance of applying virtual simulation technology in the practical teaching of chemical technology majors in secondary vocational schools. At present, the virtual simulation practical teaching platforms used by many chemical technology majors in secondary vocational schools can not only meet the teaching needs of basic experimental teaching and special skill improvement but also cover digital teaching resources such as chemical equipment, process flow, and safety emergency<sup>[8]</sup>. In practical teaching, teachers should systematically collect, screen, and integrate high-quality teaching resources related to chemical technology, including but not limited to textbooks, cases, and software tools, to build a rich and diverse teaching resource library. Then, relying on specific practical projects, update the version of the virtual simulation practical teaching platform, and construct virtual and physical real teaching resources. This allows students to use online teaching platforms to carry out practical teaching projects required for chemical positions, such as process cognition, start-up and shutdown operations, equipment disassembly and maintenance, and safety emergency handling of different chemical units and different chemical process devices. In addition, teachers should select required teaching software tools such as chemical reaction simulators and process flow simulators according to the characteristics of chemical technology courses. In this process, in addition to internal school teaching resources, teachers should also introduce the latest technologies and materials from the chemical industry and scientific research institutions to ensure that the teaching resources of the practical teaching platform remain advanced and practical. They should also regularly collect students' feedback to further optimize the platform functions and teaching resources<sup>[9]</sup>, so as to provide students with more vivid and effective learning experiences, thereby improving the quality of practical teaching of chemical technology majors and students' practical skills.

##### **4.2. Strengthening the integration of teaching and professional technology and updating the teaching system**

In the course introduction stage, make use of the visualization advantages of virtual simulation to display 3D animations and VR scenarios of the macro processes and micro reaction mechanisms of chemical production, such as feeding, gasification, purification, synthesis, and product refining. For example, when teaching the ammonia synthesis process, VR technology can be used to allow students to enter the ammonia synthesis plant to directly understand a series of devices and material flow processes, such as the production, purification, and synthesis of feed gas, overcoming the problem of "difficulty in understanding abstract principles" in previous education<sup>[10]</sup>. For some high-risk and expensive experimental operation links, such as the feeding/shutdown of chemical facilities and the transportation of flammable and explosive hazardous substances, implement them through the "virtual rehearsal - practical operation strengthening" method. Organize students to practice repeatedly on the virtual simulation platform until they are proficient in operating procedures and correct operation methods.

Finally, after assessment and evaluation, students can complete the experiments in the laboratory when they reach the corresponding level, ensuring operational safety and improving experimental results. In the comprehensive assessment stage, set up virtual comprehensive training projects such as “full-process control and fault diagnosis of chemical production”, allowing students to independently complete tasks such as process parameter setting, equipment operation, and abnormal situation handling in virtual scenarios, comprehensively assessing their comprehensive application ability of professional knowledge and skills <sup>[11]</sup>. At the same time, teachers should develop “small, refined, and practical” virtual simulation teaching resources in combination with the talent training orientation of secondary vocational chemical majors. For example, focus on core skill points such as “handling of cavitation and vapor lock of centrifugal pumps” and “adjustment of reflux ratio of distillation columns” to develop modular virtual practical teaching resources, which is conducive to improving the flexibility of students’ practice and their independent learning ability.

### **4.3. Deepening the integration of production and education based on school-enterprise cooperation and innovating teaching modes**

First of all, secondary vocational schools should cooperate with chemical enterprises and virtual simulation technology enterprises to co-construct and share virtual simulation training bases. Enterprises provide production process data, equipment technical parameters, and post-demand standards. Virtual simulation technology enterprises provide technical support, and secondary vocational schools are responsible for the integration of teaching resources and the organization and implementation of teaching, so as to realize the connection between teaching resources and enterprise needs and the consistency between training scenarios and production reality <sup>[12]</sup>. For example, a secondary vocational school and a local petrochemical enterprise co-built a “petrochemical virtual training base”, where students can simulate the full-process operation of petrochemical production, familiarize themselves with the post-operation specifications of enterprises in advance, and lay a foundation for future employment.

Secondly, incorporate chemical qualification certification standards into the virtual reality teaching evaluation system, and use virtual reality technology to carry out pre-examination training and mock exams for vocational qualifications such as chemical general controller and chemical process tester, enabling students to become compound talents who learn professional knowledge while mastering vocational qualification certification knowledge and skills <sup>[13]</sup>. At the same time, co-organize “virtual skill competitions” with enterprises, taking actual production projects of chemical enterprises as competition content, and competing students’ operational skills and problem-solving abilities through virtual simulation platforms. Outstanding competitors can obtain priority employment opportunities from enterprises, realizing the goal of “promoting learning through competitions and promoting employment through competitions.”

### **4.4. Carrying out teachers’ virtual simulation skill training and improving teacher team construction**

When applying virtual simulation technology to innovate and reform the practical teaching of chemical technology majors in secondary vocational schools, teachers, as key roles in imparting knowledge and skills, their own skills and knowledge level directly affect teaching effects and students’ learning outcomes. Therefore, higher vocational colleges should strengthen teachers’ training and education to improve their virtual simulation teaching ability <sup>[14]</sup>. First of all, secondary vocational schools should formulate scientific and reasonable teacher training programs, covering the teaching design ability, curriculum resource development ability, and relevant

teaching management ability of virtual simulation practical teaching for chemical technology majors. Secondary vocational schools can organize workshops, seminars, and other activities to make teachers familiar with the operation process of virtual simulation platforms, master how to design teaching activities suitable for virtual simulation environments, and how to effectively use virtual simulation resources to improve the quality of practical teaching of chemical technology majors. Secondly, in addition to training on teaching skills, secondary vocational schools should also pay attention to the renewal of teachers' teaching concepts. Let teachers transform to a student-centered teaching concept, innovate teaching methods, and stimulate students' enthusiasm for practical teaching<sup>[15]</sup>. In addition, on-the-job training and academic exchange activities are also effective means to improve teachers' virtual simulation teaching ability. Secondary vocational schools can organize teachers to take on temporary positions in chemical enterprises and front-line factories, allowing teachers to understand the latest development trends of the chemical industry and the application of virtual simulation technology in actual production in practical work. This not only helps teachers better integrate theory with practice but also effectively enriches the practical teaching case resources of chemical majors, thereby providing students with better quality teaching services.

## 5. Conclusion

In summary, virtual simulation technology has injected new vitality into the practical teaching of chemical technology majors in secondary vocational schools. Its application not only solves many problems in traditional practical teaching but also conforms to the development trend of vocational education reform. In the process of applying virtual simulation technology to carry out practical teaching of chemical technology majors, secondary vocational colleges should adhere to the principles of "student-centered and competence-oriented", take multiple measures to continuously optimize the teaching application path of virtual simulation technology, and thus cultivate more outstanding compound chemical technology vocational and technical talents.

## Disclosure statement

The authors declare no conflict of interest.

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# Exploration of Teaching “Motion Control System” Integrated with Curriculum Ideological and Political Education

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**Abstract:** Combined with the characteristics and talent training goals of the “Motion Control System” course for automation majors, this paper explores effective paths to organically integrate ideological and political education into professional teaching. By deeply excavating ideological and political elements such as philosophical thoughts, scientific spirit, family and country feelings, and sense of responsibility contained in the course content, and designing typical cases combined with core knowledge points such as “high precision, high dynamic response, and high reliability”, a diversified online-offline hybrid teaching model is constructed. Teaching practice shows that this exploration has effectively stimulated students’ learning motivation and innovative awareness. While imparting professional knowledge, it has cultivated students’ systematic engineering thinking, craftsman spirit, and sense of mission to serve the country through science and technology, realizing the organic unity of knowledge impartation, ability training, and value guidance.

**Keywords:** Curriculum, Ideological and political education; Motion control; Teaching reform

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## 1. Introduction

As a core course for automation majors, “Motion Control System” covers core technologies such as DC speed control systems, AC speed control systems, and servo systems. Its technical requirements of “high precision, high dynamic response, and high reliability” inherently contain rigorous scientific spirit, striving-for-excellence craftsman philosophy, and systematic engineering philosophy<sup>[1]</sup>.

However, influenced by traditional engineering education thinking, some teachers focus on explaining textbook content, emphasizing whether students can understand and master knowledge principles while ignoring the educational elements contained in the course<sup>[2]</sup>. This makes it difficult for professional courses to give full play to the role of ideological education and value guidance, and to truly implement curriculum ideological and political construction and talent training projects. Against the backdrop of increasingly fierce international manufacturing competition, China is committed to promoting a series of strategies, such as becoming a



manufacturing power, quality power, and digital power, leading the modernization and transformation and upgrading of industries, and advancing the new round of technological revolution. At the same time, national strategies and industrial transformation have put forward higher requirements for talents' engineering capabilities and comprehensive quality. This requires teachers to target the practical needs of cultivating outstanding engineering talents, attach importance to knowledge education and engineering skill training, and regard curriculum ideological and political education as an important teaching task. They should make good use of the teaching position of professional courses to infiltrate ideological and political education elements comprehensively and in-depth throughout the whole process<sup>[3]</sup>.

Therefore, based on the teaching position of the "Motion Control System" course, focusing on the integration of curriculum ideological and political education, adding the goal of value guidance and shaping on the basis of knowledge impartment and ability training, systematically reconstructing the teaching content and implementation system, and cultivating engineering talents with family and country feelings, social responsibility, and innovative spirit are imperative.

## **2. Implementation paths of curriculum ideological and political education in "motion control system"**

The key to integrating curriculum, ideological and political education is to regard professional courses as a "dish" and curriculum, ideological and political education as a "condiment". It is necessary to identify the appropriate integration methods, opportunities, and integration points to ensure that the ideological and political "condiment" matches the professional "dish", achieving the collaborative resonance of ideological and political education and professional education. The following four-in-one path is constructed<sup>[4]</sup>.

### **2.1. Improve teachers' ideological and political literacy and integration capabilities**

Teachers are the key to curriculum ideological and political education. Establish a long-term special learning and improvement mechanism to provide teacher support for the implementation of curriculum ideological and political education<sup>[5]</sup>. Strengthen beliefs through special research and learning: regularly carry out collective lesson preparation and ideological and political special teaching and research activities, study curriculum, ideological and political policy documents, and study the deeds of academicians such as Pan Jiluan and Jiang Xinsong. Draw strength from their choices and scientific research spirit of "responding to the country's needs", and internalize it into teaching appeal. Keep up with the frontier to make up for shortcomings: track the "Made in China 2025", "industrial mother machine" special projects and field frontiers, update the case database every quarter, and select domestic technological breakthrough cases such as lithography machine workbench control and industrial robot core controllers to ensure that teaching is aligned with national strategies<sup>[6]</sup>. Improve capabilities through cross-border cooperation: establish a joint teaching and research mechanism with the School of Marxism, invite ideological and political teachers to interpret the "craftsman spirit"; participate in curriculum ideological and political workshops and competitions, learn the "seamless integration" skills of excellent teachers, and improve the ability to integrate value guidance<sup>[7]</sup>.

### **2.2. Systematically excavate and sort out ideological and political elements in the course**

Excavating ideological and political elements in the professional curriculum system is a prerequisite for effective integration. It is necessary to set anchor points in professional concepts, collect ideological and political themes

with high relevance and close connection, and targetedly excavate ideological and political elements <sup>[8]</sup>.

When explaining the knowledge of “double closed-loop speed control system”, guide students to think about the conditions under which DC motors achieve optimal performance from a professional perspective, and analyze the importance of the synchronous operation of the current loop and speed loop in the entire motor system; let students regard the motor as a system from a philosophical perspective, analyze the role of each component in the operation of the overall system, and realize that only when each component keeps up with the overall development can the optimal overall operation be achieved, cultivating students’ overall concept, systematic thinking, and collaborative spirit. In the process of professional knowledge discussion and philosophical analysis, students learn to analyze problems from an overall perspective and establish a positive concept of actively improving themselves and united cooperation according to the system needs of the entire country, enterprise, or team <sup>[9]</sup>.

From “control precision and robustness” to “striving for excellence, craftsman spirit and calmness in the face of changes”: the extreme pursuit of positioning accuracy and tracking accuracy in motion control is a vivid portrayal of the “craftsman spirit” in the field of engineering and technology. By explaining the harsh requirements for micron-level and nanometer-level precision in “national heavyweight equipment” such as lithography machine workbenches and high-precision missile actuators, cultivate students’ professional belief in being meticulous about technical details and striving for excellence in product quality <sup>[10]</sup>. At the same time, the “robustness” of the system requires it to maintain stable operation and complete tasks in the face of “uncertain disturbances” such as load disturbances and parameter perturbations. We extend this to the level of personal cultivation, guiding students to recognize that they will inevitably encounter challenges from various external environments and interference from wrong ideological trends on the road of growth. They must rely on firm ideals and beliefs (set points) and strengthen the “Four Matters of Confidence” (control algorithms) to maintain political stability and the stability of life direction, achieving “remaining unyielding despite thousands of trials and tribulations, no matter which direction the wind blows.”

From “trade-off between dynamic response and stability” to “grasping the dialectics of things’ development and the art of ‘degree’”: in controller design, the rapid response and stability of the system are an eternal contradiction. Excessively pursuing rapidity will lead to overshoot or even oscillation instability, while excessive conservatism will make the system response slow. This profoundly reveals the philosophical wisdom of “going too far is as bad as not going far enough”, as well as the dialectical thinking of overall consideration and coordinated balance. We inspire students that when solving engineering problems and even dealing with personal and social relationships, they should be good at grasping the “degree”, not only dare to forge ahead and pursue efficiency, but also respect objective laws, pay attention to stability and harmony, and seek the optimal balance point in dynamics <sup>[11]</sup>.

### **3. Develop a comprehensive ideological and political case of “high-precision permanent magnet synchronous motor servo control”**

To realize the transformation of ideological and political elements from “concept” to “classroom”, we designed a comprehensive teaching case that runs through multiple knowledge points.

#### **3.1. Knowledge objectives**

Deeply understand the field-oriented control (FOC) architecture of permanent magnet synchronous motors,

master the three-loop design methods of position loop, speed loop, and current loop, and be able to analyze the impact of PID parameters on the dynamic performance (response speed, tracking accuracy) and stability of the system through simulation. Cultivate students' system-level design, debugging, and optimization capabilities, as well as the ability to solve complex engineering problems through modeling and simulation.

### **3.2. Integration and implementation of ideological and political education**

Taking how the workbench achieves nanometer-level positioning accuracy under high-speed motion as an introduction, expound the extreme importance of “a miss is as good as a mile” in high-end manufacturing and national defense security. In the parameter tuning experiment, require students to repeatedly debug until strict performance indicators are met, personally experiencing what it means to be “striving for excellence” in technology<sup>[12]</sup>.

In the simulation experiment, the integral gain was intentionally set too large to allow students to intuitively observe the dynamic process of the system from stability to oscillation instability. The teacher then guides the discussion: if personal growth is eager for quick success and instant benefits (similar to excessive integration), it will instead lead to imbalance in mentality and irregular behavior, resulting in system collapse. Thus, it is emphasized that we must take correct values as the “control law” and a profound academic foundation as the “system model” to maintain the “asymptotic stability” of life direction under various disturbances.

## **4. Construct an integrated hybrid teaching model of “online-offline, in-class and after-class”**

To overcome the contradiction between limited class hours and rich content, and adapt to the learning habits of the new generation of students, we constructed a diversified teaching model.

Use online course platforms to release shocking clips related to high-speed railways, precision assembly of industrial robots, etc., from documentaries such as “National Heavyweight Equipment” and “Innovative China” in advance, allowing students to intuitively feel the charm and value of motion control through visual impact, and stimulate national pride and learning motivation<sup>[13]</sup>.

Flexibly use and intersperse various teaching methods in offline classes, set exploratory questions, introduce cases with ideological depth, and trigger students' philosophical thinking on professional scenarios and problems<sup>[14]</sup>. When explaining PID controllers, use analogies to let students combine the characteristics of proportional (P), integral (I), and derivative (D), place them in professional scenarios, and analyze what good qualities and work styles the three possess, such as P: decisive execution; I: perseverance; D: preventing problems before they occur. This vivid analogy helps students deeply understand knowledge, triggers their thinking about the values behind professional principles, and subtly influences their values. In case teaching, design question chains based on case content, allowing students to explore and solve problems in groups, exercising their team cooperation learning ability and dialectical thinking ability<sup>[15]</sup>.

Assign comprehensive assignments, including system modeling, controller design, and simulation analysis, encouraging students to try different control strategies. In the experimental link, emphasize safety norms and team cooperation. At the same time, use the testing and questionnaire functions of the platform to timely check the degree of knowledge mastery, and collect students' feelings and suggestions on the integration methods of ideological and political education, forming an effective closed loop of “teaching-feedback-improvement” to continuously optimize the teaching process.



## 5. Teaching practice effects

After two years of teaching practice, the curriculum ideological and political reform has achieved remarkable results, which are reflected not only in quantitative achievements but also in students' spiritual and value changes.

### 5.1. Learning motivation: From “passive exam-oriented learning” to “active responsibility”

Ideological and political elements have injected warmth into professional knowledge. Students' questions have extended from “how to use formulas” to “how technology can serve national upgrading”; the number of after-class discussion groups has increased significantly, and the borrowing rate of related professional books has further improved. The learning state has changed from “learning for credits” to “learning to serve the country”.

### 5.2. Practical ability: From “completing tasks” to “pursuing excellence”

The craftsman spirit and innovative awareness have been transformed into practical action. Students take the initiative to optimize performance in experiments, and have won 3 national awards and more than 10 provincial and ministerial awards based on course knowledge. Works such as “intelligent car control experiments” reflect their understanding and innovative application of professional technology.

### 5.3. Value orientation: From “technology-oriented” to “responsibility-first”

Most students take the initiative to cooperate in teams and show perseverance in the face of technical difficulties; at the same time, the implementation of curriculum ideological and political education has guided students to integrate advanced values into current study and career development, establishing the struggle and development goal of “serving the country through science and technology and participating in the upgrading of the manufacturing industry”, laying the foundation for growing into engineering talents with both virtue and ability.

## 6. Conclusion

The practice of this curriculum's ideological and political reform shows that it is feasible and necessary to carry out ideological and political education in engineering courses. The key is to abandon rigid grafting and realize “seamless integration” of professionalism and ideological and political education through the four-in-one path of “improving teacher quality, excavating ideological and political elements, innovating teaching models, and closed-loop feedback”. Professional teaching provides a career for ideological and political education, and ideological and political education injects motivation into professional learning, ultimately achieving the coordination of the three goals of “knowledge, ability, and value”. While mastering the knowledge and principles of motion control, students have acquired the ability to apply knowledge to practice and solve complex engineering problems, and have integrated serving the country through science and technology into their own ideals, forming a steady and progressive, collaborative thinking concept, and a craftsman spirit of pursuing excellence.

Looking forward to the future, the construction of curriculum ideological and political education has a long way to go. This research is only an exploration and the beginning of a stage. In the next step, the teaching team will continue to deepen, reflect, and innovate, continuously deepen the integration and innovation of professional education and ideological and political education, and strive to build “Motion Control System” and other professional courses into a strong position for cultivating outstanding engineering talents of the new era who are

both virtuous and talented and can shoulder the responsibility of national rejuvenation.

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# Research on the Application of Traditional Culture in Ideological and Political Education of Higher Vocational Education

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**Abstract:** Excellent traditional Chinese culture is the spiritual lifeblood of the Chinese nation, containing rich ideological and political education resources. Integrating traditional culture into ideological and political education in higher vocational colleges can enhance the effectiveness of ideological and political education, strengthen students' cultural confidence, and help fulfill the fundamental task of fostering virtue through education. Based on the professional attributes and student characteristics of higher vocational education, this paper analyzes the contemporary value and integration principles of integrating traditional culture into ideological and political education in higher vocational colleges, and explores effective application paths. It aims to provide theoretical reference and practical experience for building a culturally distinctive ideological and political education model in higher vocational colleges, and help cultivate high-quality technical and skilled talents with both moral integrity and professional competence as well as cultural confidence.

**Keywords:** Traditional culture; Ideological and political education in higher vocational colleges; Application paths; Fostering virtue through education; Cultural confidence

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## 1. Introduction

Excellent traditional Chinese culture is the spiritual wealth of the Chinese nation, and the root and soul of the nation. At present, the country attaches great importance to the inheritance and development of excellent traditional Chinese culture, emphasizing the integration of traditional culture into the entire process of education. Ideological and political education in higher vocational colleges should also rely on local cultural advantages, exploring ideological and political elements in traditional culture to enrich the connotation and improve the effectiveness of ideological and political education. Therefore, ideological and political educators in the new era should raise their awareness, create conditions, and promote the in-depth integration of traditional culture and ideological and political education. This is of great practical significance and contemporary value for enriching the content of ideological and political education, improving the quality of education, and enhancing students'

cultural confidence.

## **2. Contemporary value of integrating traditional culture into ideological and political education in higher vocational colleges**

### **2.1. Consolidate the cultural foundation of the sinicization of Marxism**

Spiritual traits in traditional culture, such as patriotism, collectivism, self-improvement, and virtue, coincide with the people-centered stance, collectivist ideas, and dialectical materialist perspectives in Marxist theory<sup>[1]</sup>. Integrating traditional culture into ideological and political education in higher vocational colleges enables Marxist theory to take root in the cultural soil. Through concrete cultural carriers and vivid historical stories, the basic principles and values of Marxist theory can be explained more vividly and specifically, helping students better understand the historical and cultural logic of the Sinicization of Marxism, and enhancing their sense of identity and belonging to the path, theory, system, and culture of socialism with Chinese characteristics.

### **2.2. Enrich the content and educational effectiveness of ideological and political education**

Ideological and political education in higher vocational colleges needs to provide ideological guidance for students and cultivate their good moral qualities and professional literacy. Traditional culture covers philosophy, moral norms, humanistic spirit and other fields, providing an inexhaustible treasure trove of resources for ideological and political education<sup>[2]</sup>. For example, the craftsman spirit of “polishing and refining like carving jade”, the family and country feelings of “everyone is responsible for the rise and fall of the nation”, and the professional ethics of “dedicating to one’s duties” and “reflecting on reverence in work”. These contents in traditional Chinese culture can supplement the content system of ideological and political education, broaden the educational dimension, and meet the needs of the all-round development of higher vocational students.

### **2.3. Align with the educational goal of “integrating moral integrity and professional competence” in vocational education**

The “National Vocational Education Reform Implementation Plan” clearly proposes that vocational education should adhere to the educational policy of “integrating moral integrity and professional competence, combining work and study”. Therefore, the talents cultivated by higher vocational colleges should be high-quality talents with exquisite skills, good moral qualities and professional literacy<sup>[3]</sup>. The craftsman spirit of excellence, professional ethics based on integrity, and the practical concept of “the unity of knowledge and action” contained in traditional culture are consistent with the goal of cultivating professional literacy in higher vocational colleges. Integrating these cultural elements into ideological and political education can guide students to cultivate professional qualities such as dedication, trustworthiness, excellence, and innovation while mastering professional skills, so as to achieve more comprehensive development.

## **3. Principles for integrating excellent traditional Chinese culture into ideological and political education in higher vocational colleges**

### **3.1. Adhere to the orientation of fostering virtue through education**

Integrating traditional culture into ideological and political education in higher vocational colleges should firmly grasp the fundamental task of fostering virtue through education, fully reflect socialist core values, guide



students to establish correct outlooks on the world, life, and values, and cultivate patriotism. At the same time, it is necessary to improve students' moral literacy and mental health, and promote their all-round development to meet the needs of the times for compound, innovative, and applied talents <sup>[4]</sup>. This requires higher vocational education to adhere to moral education first, dig deep into the moral education resources in traditional culture, combine them with the cultivation of professional ethics, the improvement of legal literacy, and mental health education, give full play to the moral education and value cultivation role of excellent traditional Chinese culture, and fulfill the mission of "cultivating talents for the Party and the country" <sup>[5]</sup>.

### **3.2. Based on the characteristics of vocational education**

Vocational education is essentially employment-oriented, aiming to promote students' smooth employment. The integration of ideological and political education and traditional culture in higher vocational colleges should be combined with the characteristics of vocational education, and content should be selected according to students' majors to avoid the separation of culture and majors <sup>[6]</sup>. Therefore, schools need to base their vocational education practice and school reality, select cultural resources matching with majors, organically integrate cultural education with professional ability training, and let students clarify their career pursuits in cultural nourishment, so as to improve the pertinence and effectiveness of education.

### **3.3. Grasp the general trend of era development**

Education should promote the resonance between traditional ideas and the spirit of the times. For example, combining the people-oriented thought with the concept of "putting the people first", and integrating the family and country feelings with the spirit of patriotic dedication, so that traditional cultural ideas can adapt to the needs of contemporary society <sup>[7]</sup>. Ideological and political workers need to base their work on students' life practice, inject contemporary connotations into traditional culture, and innovate communication methods. With the help of new media platforms such as WeChat, Douyin, and Bilibili, classic culture can be transformed into content forms popular among students. Through the innovation of discourse expression and communication paths, the limitations of traditional education can be broken, making excellent traditional culture radiate new vitality on campus and enhancing students' emotional resonance and cultural identity.

## **4. Challenges faced by the integration of traditional culture into ideological and political education in higher vocational colleges**

### **4.1. Imperfect educational system**

The relevant system for integrating excellent traditional Chinese culture into ideological and political education in colleges and universities is not yet perfect. The reason is that the ideological and political elements in traditional culture have not been fully explored, and ideological and political workers also find it difficult to effectively use these resources, leaving room for exploration in the in-depth integration of the two. In addition, under the tide of globalization and informatization, college students pay insufficient attention to traditional culture, and non-relevant major students rarely have systematic learning opportunities. The traditional culture education in some colleges and universities is superficial, and coupled with the impact of students' employment and further study pressure, it is difficult to form a complete path for the promotion of relevant education, and the relevant system needs to be further enriched.



## **4.2. Single teaching model**

The integration of excellent traditional Chinese culture into ideological and political education mainly relies on ideological and political classrooms, where teachers explain relevant knowledge. Although this can let students have a preliminary understanding of traditional culture, it lacks flexibility and is difficult to meet the individual cognitive differences of students. At present, although many colleges and universities try to broaden the path by connecting inside and outside the classroom, online and offline, classroom teaching on campus is still the mainstream, and the educational form needs to be further enriched.

## **4.3. Need for improvement in teachers' quality**

At present, some teachers in higher vocational colleges have insufficient cultural knowledge reserves. Although teachers have a certain knowledge foundation, they still lack in-depth understanding of traditional culture and need to learn more to strengthen their knowledge reserves. In addition, teachers' attention to the integration of excellent traditional culture into ideological and political education needs to be improved. Although some teachers have the willingness to integrate, how to integrate and the effect of integration are limited by factors such as teaching tasks and teaching ability.

# **5. Application paths of traditional culture in ideological and political education in higher vocational colleges**

## **5.1. Construct a three-dimensional education system to achieve full coverage of cultural education**

### **5.1.1. Take ideological and political courses as the leading role and dig deep into cultural and ideological and political elements**

Ideological and political courses are highly consistent with traditional culture in educational philosophy. For example, the traditional educational thought of “teaching without discrimination” is in the same line as the people-oriented concept of ideological and political courses, both pointing to educational equity and student growth. As the main position of ideological and political education in colleges and universities, ideological and political courses should deeply explore the educational elements of traditional culture and organically integrate them with Marxist theory education<sup>[8]</sup>. Teachers should improve their traditional cultural literacy, truly learn, understand, believe in and apply traditional culture, select appropriate content in teaching, and combine traditional ideas such as moral cultivation with the goal of cultivating “four have” new people. Following the principle of explicit integration and implicit penetration, traditional culture can be vivid in theoretical explanation.

### **5.1.2. Take professional courses as a career to realize the integration of culture and profession**

Promote the integration of traditional culture and professional courses, and cultivate students' professional skills and cultural literacy. According to the characteristics of different majors, select traditional elements related to career development<sup>[9]</sup>. For example, in manufacturing majors, integrate the craftsman spirit of excellence and focus on cultivating students' innovative ability; in service majors, integrate the way of dealing with people, such as integrity, kindness, and harmony, so as to improve students' service awareness and communication ability. Let students feel the value of traditional culture in the process of professional learning, and realize the collaborative educational goal of improving skills, cultivating good moral character, and inheriting culture.

### **5.1.3. Take campus culture as a supplement to create an immersive educational atmosphere**

A good learning and living environment plays a positive role in promoting the ideological and political construction of college students, and campus culture is an important channel to create a good environment. Higher vocational colleges can build cultural corridors and traditional garden landscapes on the campus, allowing students to be immersed in an environment full of a traditional cultural atmosphere. They can also hold interactive activities such as calligraphy competitions and intangible cultural heritage skill experiences, so that students can feel the charm of traditional culture through rich campus activities<sup>[10]</sup>.

### **5.2. Innovate teaching methods and carriers to enhance educational attractiveness**

Higher vocational colleges should provide new teaching methods and means for ideological and political education to stimulate students' learning interest and enthusiasm, and improve the effectiveness of ideological and political education. To this end, higher vocational colleges can break through traditional classroom teaching activities, organize students to visit cultural relics sites, museums, intangible cultural heritage exhibition centers, etc., and carry out experiential teaching activities<sup>[11]</sup>. They can also invite traditional artists and scholars to the campus to display their skills or give special lectures, allowing students to have close contact with traditional culture.

In addition, it is necessary to make full use of modern information technology to innovate the dissemination and teaching methods of traditional culture. For example, schools can develop digital teaching resources of traditional culture, such as micro-courses, MOOCs, and virtual simulation courses, to provide students with richer learning resources; seize the initiative of online platform publicity, build cultural communication accounts with the help of new media platforms such as WeChat, Douyin, and Bilibili, and carry out activities such as short video promotion, live sharing, and interactive topics to spread traditional cultural knowledge and ideological and political concepts.

### **5.3. Strengthen the construction of teachers' team to lay a solid foundation for integrated education**

To strengthen the country, we must first strengthen education; to strengthen education, we must first strengthen teachers. Higher vocational colleges should start from the source of teacher training and improve the quality of teacher training<sup>[12]</sup>. Regularly organize ideological and political education and professional teachers to participate in special training on traditional culture and cultural inspection activities to learn traditional cultural knowledge and improve teachers' understanding and cognition of traditional culture. Encourage teachers to deeply study Marxist classic works, the more than 100-year struggle history of the Communist Party of China, and excellent traditional Chinese culture, and constantly enhance theoretical confidence<sup>[13]</sup>. At the same time, organize teachers to learn advanced teaching methods, such as digital teaching and project-based teaching, to improve teachers' ideological and political education ability, and then improve the teaching effect of ideological and political education. In addition, higher vocational colleges should rely on existing resources to attract high-level talents, optimize the talent structure according to the school's development goals and teaching needs, combined with various construction needs, and provide teachers' guarantee for ideological and political education.

### **5.4. Deepen the integration of social practice to promote the unity of knowledge and action**

Ideological and political education cannot stay at the theoretical level, but must be combined with reality. Higher vocational colleges should attach importance to social practice as an effective means to cultivate and

shape college students' outlook on life, values, and ideological awareness <sup>[14]</sup>. First, higher vocational colleges can organize cultural inheritance practice activities. Organize students to participate in traditional culture protection and inheritance practice activities, such as participating in the survey of intangible cultural heritage, the promotion of traditional skill inheritance, and volunteer services for the protection of cultural relics sites, so that students can understand the current situation and inheritance dilemmas of traditional culture in practice, and enhance their sense of responsibility and mission for cultural inheritance.

Second, schools can carry out volunteer service practice. Integrate the benevolence and dedication spirit in traditional culture into volunteer service activities, organize students to carry out volunteer services such as “helping the elderly and children”, “community services”, and “public welfare lectures”, guide students to practice traditional virtues in serving others and contributing to society, and improve their moral realm; carry out themed volunteer services in combination with traditional festivals, such as sending Spring Festival couplets during the Spring Festival, making zongzi during the Dragon Boat Festival, and visiting the elderly during the Mid-Autumn Festival, so that students can enhance their sense of social responsibility and service awareness while inheriting festival culture.

Third, vocational experience practice can be carried out. Higher vocational colleges can rely on the school-enterprise cooperation platform to integrate traditional culture into students' internship and training links <sup>[15]</sup>. During internships in enterprises, guide students to learn the craftsman spirit and integrity culture of enterprises, and combine traditional professional ethics with modern professional norms; encourage students to use ideas such as “harmony in diversity” to handle team relations and the attitude of “striving for perfection” to improve work quality in internship practice, so as to enhance their professional ability and cultural literacy.

## **5. Conclusion**

Ideological and political education in the new era should take root in traditional culture, draw wisdom from it, and deepen the educational connotation. Higher vocational colleges should fully recognize its importance and urgency, actively carry out exploration, and bravely put it into practice. Under the impact of diverse value orientations, we should take multi-dimensional measures to promote the integration of traditional culture and ideological and political education by reconstructing the curriculum system, innovating teaching methods and carriers, strengthening the construction of teachers' team, and deepening the integration of social practice, so as to improve the quality of ideological and political education, cultivate high-quality technical and skilled talents, and let traditional culture radiate new vitality in ideological and political education of higher vocational colleges.

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# Research on Strategies for Universities to Optimize Educational Management and Improve Talent Training Quality and Efficiency Based on Big Data

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**Abstract:** With the continuous development of science and technology, China has gradually entered the era of big data. Universities have also adapted to the changes of the times to optimize and innovate educational management work. Aiming at improving the quality and efficiency of university talent training, this paper explores the practical paths for universities to use big data to optimize educational management. First, it analyzes the value dimensions of big data empowering university educational management; second, it examines the current practical dilemmas of universities in data governance, technology application, talent reserve, etc.; finally, it puts forward specific strategies from four aspects: constructing a data governance system, optimizing the teaching management model, carrying out precise student services, and improving the decision support mechanism. It aims to provide a useful reference for universities to realize the upgrading of educational management relying on big data and cultivate advantageous talents adapting to the development of the digital economy.

**Keywords:** Universities; Big data; Educational management; Talent training; Quality and efficiency improvement

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## 1. Introduction

With the development of information technology, big data has become an important force driving changes in the field of education. The “Opinions on Accelerating the Digitization of Education” jointly issued by the Ministry of Education and eight other departments clearly proposes to promote the integrated governance of educational data and facilitate artificial intelligence to assist educational reform. To cope with the arrival of the big data era, universities need to carry out a series of innovative attempts in student management models, innovate management concepts, and use big data to realize the scientificization, precision, and intelligence of educational management, optimize the learning environment for students, and promote their all-round development.



## **2. Value dimensions of big data empowering university educational management**

### **2.1. Reconstruct teaching logic and promote precise talent training**

The traditional educational management model has unified processes and rules, which is difficult to meet the needs of students' personalized development. Entering the era of big data, it is possible to collect students' learning and living data, analyze and summarize valuable data among them, and make scientific decisions in combination with the actual situation of universities <sup>[1]</sup>. In this context, educational management no longer needs to be limited to the subjective judgments and management experience of experts or managers, but makes more democratic, scientific, and flexible decisions based on objective data and actual conditions. For teachers, they can analyze students' learning situations by collecting massive data, formulate personalized educational plans for students, and realize precise teaching.

### **2.2. Optimize management processes and improve service efficiency**

By building an integrated data sharing platform with big data technology, universities can break the information barriers between different departments and collect and manage data from links such as enrollment, student status, academic affairs, and employment. In academic management, analyzing students' course selection data and teachers' teaching evaluation can more accurately adjust curriculum settings and optimize teacher allocation; in employment services, integrating students' professional ability data with enterprise recruitment demand information can predict the employment trends of various majors and provide more targeted employment guidance for students <sup>[2]</sup>. The effective integration of data makes educational management services more efficient. While simplifying work processes and reducing repetitive work, it can also provide stronger support for students' growth and effectively improve their learning quality.

### **2.3. Support scientific decision-making and strengthen strategic guidance**

University development decisions need comprehensive and objective data as support. Big data technology can integrate various data in the process of university operation, such as teaching quality data, scientific research achievement data, and resource allocation data. Through data modeling and visual analysis, it can provide a scientific basis for the university's discipline construction, professional layout, and revision of talent training programs <sup>[3]</sup>. For example, universities can collect employment data of graduates, integrate and analyze it, and adjust the current professional structure according to the needs of regional digital economic development, add emerging majors such as artificial intelligence and data science, and cultivate talents that meet the needs of the times.

## **3. Practical dilemmas of universities in optimizing educational management based on big data**

### **3.1. Imperfect data governance system and weak foundation support**

The use of big data in educational management will naturally involve data governance issues. At present, some universities are facing problems such as inconsistent data standards, uneven data quality, and difficulty in ensuring data security <sup>[4]</sup>. The reasons are as follows: first, each management system is developed by different manufacturers, with differences in data formats and coding rules, making data interoperability difficult; second, the quality of collected data varies, with problems such as duplicate, missing, and incorrect data, which affect the application effect of data; third, the awareness of protecting students' private data is insufficient, and there is a



risk of data leakage. Balancing data privacy and data freedom is a key factor affecting educational management.

### **3.2. Insufficient depth of technology application and unhighlighted integration efficiency**

Universities can recognize the importance of big data for educational management, but how to apply big data in actual educational management and then innovate the traditional educational management model is a problem faced by most schools currently. The problem lies in that teaching management, it mainly focuses on data statistics and simple analysis, and fails to monitor and intervene in the teaching process through data mining and analysis<sup>[5]</sup>. In student management, data is mainly applied at the basic level of checking students' attendance and reward and punishment measures, and fails to build personal growth portraits for students. Managers lack awareness of big data applications, and the application of data in the management process remains superficial and fails to be implemented in management work, so it is naturally difficult to improve management efficiency.

### **3.3. Shortage of compound talents and insufficient professional support capacity**

The application of big data naturally requires universities to provide professional management talents who not only have educational management capabilities but also master data collection, analysis, and application capabilities. At present, most of the personnel engaged in educational management in universities have traditional management backgrounds and lack professional data science knowledge and skills<sup>[6]</sup>. At the same time, talents in data science are mostly concentrated in the fields of scientific research and teaching, and few are involved in educational management. Universities' educational management is short of compound talents, and it is necessary to continuously cultivate and attract excellent teachers and managers to cope with the challenges of educational management.

### **3.4. Inadequate institutional guarantee mechanism and unformed application ecosystem**

To give full play to the practical value of big data, universities should improve institutional guarantees and build a good educational ecosystem for the application of big data. However, at present, most universities have not established a systematic and perfect data management system, lacking unified standards for big data collection scope, sharing authority, usage specifications, and responsibility division. Each department manages data independently, making data interoperability and sharing difficult<sup>[7]</sup>. At the same time, the standardized application of big data in educational management is still in the initial exploration stage, lacking unified technical interfaces, data formats, and operating procedures. There are technical barriers to data interoperability across departments and systems, which affect the value of big data technology in educational management.

## **4. Core strategies for universities to optimize educational management based on big data**

The purpose of universities using big data to optimize educational management is to solve the problems in the traditional management model through data-driven approaches and improve the precision and effectiveness of talent training. Combining the characteristics of big data technology and the laws of university educational management, focusing on the whole process of talent training, a strategic system is constructed from five dimensions: concept innovation, technical support, optimization of teaching management processes, innovation of student services, and long-term guarantee to optimize educational management and then improve the quality and efficiency of talent training.

#### **4.1. Establish a data-driven concept and lay a solid foundation for management thought**

First of all, universities should innovate at the ideological level, break the traditional empiricist thinking, and build a management cognitive system empowered by data. Therefore, university management should set an example, take the lead in promoting the popularization of big data concepts, carry out relevant special training, academic seminars, case sharing and other activities, convey the ideological concept of speaking with data, making decisions with data, and managing with data to all faculty and staff, clarify the value of big data in optimizing teaching processes, accurately serving students, and scientifically allocating resources, and eliminate the resistance of managers.

In addition, it is necessary to establish a people-oriented data application orientation, emphasize the essential purpose of data serving talent training, and not make conclusions based solely on data. In the process of data collection and application, it is necessary to collect data comprehensively, explore students' learning rules and growth needs through integrating a large amount of data, and pay attention to the cultivation of emotional care and humanistic literacy. At the same time, it is necessary to strengthen the awareness of data security and privacy protection, use data safely and in compliance, and guide managers to collect, store, and use data standardizedly<sup>[8]</sup>.

#### **4.2. Construct an integrated data system and strengthen management technical support**

First, establish a unified data standard and sharing platform. With reference to national educational data standard specifications, integrate scattered data from various systems such as academic affairs, students, scientific research, and assets, unify formats, codes, and collection standards, and clarify the list of departmental data responsibilities. Build an integrated data management platform to centrally integrate data from the entire chain of enrollment, teaching, internship, and employment, realize data interoperability between departments, and provide data support for the whole-process management of talent training<sup>[9]</sup>.

Second, strengthen data quality control and build a full-process system of “collection-cleaning-verification-update”. Automatically collect data through multiple channels such as intelligent terminals and sensors to reduce errors caused by manual collection. Use algorithms to remove duplicate and incorrect data to improve data purity. At the same time, establish a quality evaluation index system, conduct regular audits and incorporate them into departmental assessments to ensure data accuracy and availability.

Third, build a solid data security barrier, formulate hierarchical and classified management methods, encrypt sensitive data, and clarify access rights and usage specifications. Use technologies such as data desensitization and log auditing to strengthen the whole-life cycle management and prevent data leakage, tampering and other incidents<sup>[10]</sup>. Establish an emergency response mechanism and conduct regular safety drills to make rapid responses when problems occur.

#### **4.3. Optimize teaching management processes and improve the precision of talent training**

Teaching management is the core link of talent training, and it is necessary to use big data to make the management process more refined and personalized. Universities can create a precise teaching model, collect and analyze students' classroom interaction, homework quality, online learning time and other data, build students' personal learning portraits, and clarify students' weak points and interest preferences. Implement differentiated teaching strategies based on portraits, push personalized resources and tutoring plans for individual students, divide learning groups for different needs, design targeted teaching content, and tailor teaching to students in accordance with their aptitude<sup>[11]</sup>. At the same time, collect teaching process data in real time and adjust teaching rhythm and methods accordingly.

Use big data to analyze industry development trends, market talent demand, and graduates' employment feedback, grasp social demand for talents, and optimize talent training programs. Combine disciplinary characteristics and faculty advantages, adjust professional settings and curriculum systems, add emerging interdisciplinary courses, strengthen practical teaching links, and increase the proportion of school-enterprise cooperation courses and on-the-job internships<sup>[12]</sup>.

#### **4.4. Innovate student management models and promote all-round development**

Student management needs to transform to refinement, relying on big data. Universities can build a comprehensive student growth monitoring system, integrate multiple information such as student status, learning, life, psychological evaluation, and social practice, and establish dynamically updated growth portraits. Analyze portrait data through algorithm models to timely identify early warning signals such as academic decline, abnormal consumption, and abnormal psychological indicators, and launch a joint assistance mechanism involving counselors, professional teachers, and psychological counselors to detect, intervene, and assist students in solving problems in study and life at an early stage.

Based on growth portraits and career interest data, provide students with customized academic planning and career guidance. Recommend suitable professional directions, elective courses, and scientific research projects to guide students to clarify learning goals; integrate enterprise recruitment and industry trend data, push matching job information, and carry out personalized services such as resume optimization and interview coaching to improve employment competitiveness<sup>[13]</sup>.

#### **4.5. Improve faculty and institutional guarantees and lay a foundation for long-term development**

To optimize higher education management, universities can build a professional team of educational management talents through multiple paths. Internally, build learning and exchange platforms for managers, provide targeted training resources to help them improve their data application capabilities, and consolidate the professional quality of the educational management team; at the same time, take data application level as an important reference for managers' career development, guide everyone to take the initiative to learn big data application technologies and management knowledge, and form a positive learning atmosphere<sup>[14]</sup>.

Externally, absorb professional talents with expertise in data processing and intelligent technology, invite senior enterprise practitioners to participate in guidance work, and bring cutting-edge practical experience from the industry. Establish a collaborative team composed of personnel in fields such as educational management, data application, and subject teaching, and gather wisdom from multiple parties to promote the implementation of big data in educational management<sup>[15]</sup>.

In terms of system construction, universities need to issue relevant regulations on data use, safety protection, and application standards, and clarify the responsibility boundaries of all participants in the whole data process. Incorporate the actual effect of big data application into the work evaluation system of departments and individuals, and affirm outstanding collectives and individuals; at the same time, deepen school-enterprise cooperation, build industry-university-research collaborative platforms with enterprises, and promote the development of specific work such as data platform construction and practical curriculum design, so as to provide practical guarantee for big data to empower educational management.

## 5. Conclusion

Educational digitization has brought historic opportunities for university educational reform, and big data technology has become an innovative force driving the transformation and development of university educational management. Universities should integrate big data technology into the educational management process, optimize educational management work according to the school's characteristics and students' actual conditions, promote the transformation of educational management towards a more intelligent, personalized, and scientific direction, and provide more possibilities for the development of higher education.

## Disclosure statement

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# Role Positioning and Ability Construction of International Student Counselors in Chinese Universities from the Perspective of Cross-cultural Education

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**Abstract:** The globalization process is accelerating, and the demand for talents with cross-cultural communication ability is also increasing, which requires the traditional knowledge teaching to be transformed into the cultivation of cross-cultural critical thinking ability, and puts forward new requirements for the ability of college counselors. In this regard, the following explores the role positioning and capability building strategies of international student counselors in Chinese universities from the perspective of cross-cultural education. It clarifies the roles of university counselors as cross-cultural educators, cross-cultural managers, and cross-cultural communicators. Through activities such as professional skills competitions and cross-cultural academic seminars, it systematically enhances cross-cultural communication skills and professional competencies in multicultural environments.

**Keywords:** Intercultural education; College counselors; Role positioning; Capacity building

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## 1. Introduction

The new era emphasizes the cultivation of globally competent talents. As cross-cultural educators, university international student counselors must undertake systematic educational responsibilities. By continuously enhancing their professional competencies and ethical standards, they can clearly define their educational mission in an open global context. This approach not only advances the professionalization of university counselor teams but also strengthens international educational collaboration.



## **2. Role positioning of international student counselors in Chinese universities from the perspective of cross-cultural education**

### **2.1. Cross-cultural educators**

From the perspective of cross-cultural education, university counselors of international students are responsible for helping international students quickly adapt to the learning and living environment, clarifying their identity as cross-cultural educators, and focusing on educating them about China's laws and regulations, school rules, national conditions, and school-specific circumstances <sup>[1]</sup>. Meanwhile, to better assist international students in adapting to cultural differences, we will focus on explaining dietary and etiquette norms through the example of Sino-German cultural differences, helping German students adjust more quickly. Additionally, it is essential to promote China's excellent traditional culture, cultivate international students' cross-cultural thinking awareness, and enhance their cross-cultural understanding capabilities. On this foundation, systematic theoretical teaching can help international students adapt more effectively to new environments.

### **2.2. Cross-cultural managers**

College counselors also manage daily affairs for international students, including providing consultations, information, and organizing cultural and sports activities. This requires them to coordinate cross-cultural conflicts, which demands cross-cultural adaptability, understanding and adapting to values, behavioral norms, and communication styles across different cultural backgrounds to better address contradictions and conflicts arising from cultural differences. Additionally, counselors must possess cultural sensitivity, deeply understand the cultural connotations of both Chinese and German cultures, and identify cultural differences and potential conflicts, such as individualism versus collectivism. German culture is centered on individualism, emphasizing personal abilities and achievements, while China places greater emphasis on teamwork and collective interests. This requires counselors to demonstrate cultural sensitivity <sup>[2]</sup>.

### **2.3. Cross-cultural communicators**

From the perspective of cross-cultural education, as a bridge for Sino-German cultural communication, international student counselors in Chinese universities need to possess certain cross-cultural communication skills, master cross-cultural communication techniques, and quickly adapt to the differences between Chinese and German education systems <sup>[3]</sup>. It is essential to not only understand the cultural background of German students but also to gain a deep insight into the differences between China and Germany in terms of values, social habits, and etiquette norms. While respecting cultural differences and avoiding misunderstandings that may lead to conflicts, it is equally important to effectively convey China's cultural values in cross-cultural communication. This approach will better facilitate cultural integration between both sides, promote cross-cultural exchange, and enable flexible responses to new challenges in Sino-German cross-cultural communication with an open mindset.

## **3. Ability construction methods of international student counselors in Chinese universities from the perspective of cross-cultural education**

### **3.1. Regularly organize specialized training activities**

From the perspective of cross-cultural education, the capacity building of university student counselors in China can adopt regular training programs, combining international student affairs practices to enhance their professional competence and expertise, thereby enabling them to better perform their role as cross-cultural

managers <sup>[4]</sup>. The process includes training on regulations and culture, professional skills (daily management, emergency response, mental health education), language and communication skills, and personalized service. Taking the training of personalized service capabilities as an example, how to provide personalized consultation and assistance based on the cultural background of German students, and offer counselors various consultation cases during the training process, such as adaptation to religious beliefs, and provide interpretation services on legal and religious policies regarding the religious management regulations of China that German students may have, requiring counselors to understand the religious needs of German international students in advance during the training process and provide cross-cultural communication and psychological support services <sup>[5]</sup>. In this case, the counselor's personalized service ability is significantly enhanced, which can provide better support for international students in life and study, and help the counselor's intercultural communication ability and intercultural affairs management ability.

### 3.2. Organizing cross-cultural academic seminars

To enhance the capacity of international student counselors in Chinese universities, cross-cultural academic symposiums can be organized. These symposiums should analyze the essential cross-cultural communication skills, cultural adaptability, and international education methodologies required from four perspectives: intercultural communication, intercultural education, intercultural management, and intercultural research. By sharing practical training experiences, counselors can continuously improve their professional expertise and international service capabilities through interactive exchanges <sup>[6]</sup>. Furthermore, cross-cultural academic symposiums may adopt a hybrid online-offline format (**Figure 1**), enabling scholars to examine international student education management from an academic standpoint. This approach facilitates the identification of research topics and methodologies, thereby strengthening the integration of theoretical research with practical implementation. Regarding the educational management issue of cultural adaptation and integration, the academic research topic was determined as “cross-cultural integration.” By adopting the survey research method, practical investigations were conducted among international students from different countries to understand the difficulties in cross-cultural adaptation, such as differences in language, living habits, and values compared to China. Through these investigations, the challenges in cultural adaptation for international students were identified, enabling the proposal of solutions based on the actual issues encountered during their cultural adaptation process. The aim is to enhance the management efficiency of international students from multiple perspectives <sup>[7]</sup>.



**Figure 1.** Cross-cultural academic symposiums are conducted both online and offline.

### 3.3. Organizing a career competency competition

The construction of international student counselors in our university needs to hold the corresponding professional quality ability competition, and constantly improve the ability of counselors to adapt to the multicultural environment, while promoting learning by competition. This process simulates various international scenarios, enabling counselors to respond proactively in diverse cross-cultural situations and evaluate their cross-cultural service capabilities. Through this competency assessment, counselors can identify gaps in handling international affairs via post-competition analysis, thereby continuously refining their emergency response skills and enhancing adaptability to cross-cultural environments <sup>[8]</sup>. For example, in a cross-cultural setting where German students have established practices like fixed prayer times and Sunday observances, what arrangements should the counselor make? In response to this cross-border scenario, the participating counselor made the following arrangements (**Table 1**).

**Table 1.** Specific performance of counselors in the competition

International scenarios	Counselor arrangements
International Students' Fixed Prayer Day Event	<ol style="list-style-type: none"><li>1. Understanding the Needs of International Students on Religious Activities Through the Admission Questionnaire and Individual Interview</li><li>2. Based on understanding the needs, arrange time and space reasonably, coordinate with the teaching time of professional courses, and provide a quiet private space for prayer, and inform other students to avoid disturbing</li><li>3. Make arrangements for food and drink. If you have dietary restrictions due to religion, you need to help the canteen to provide meals that are in line with your habits in advance.</li><li>4. Provide psychological support services, as international students may easily feel lonely or experience cultural conflicts due to differences between their religious beliefs and China's mainstream culture.</li></ol>

During this competency assessment, expert judges evaluate counselors' responses to various scenarios, such as addressing international students' psychological needs, building trust, and providing tailored support in daily management. This approach effectively enhances learning and critical thinking through competition, ultimately improving counselors' professional competence <sup>[9]</sup>.

## 4. Conclusion

In conclusion, from the perspective of cross-cultural education, international student counselors in Chinese universities should clearly define their roles and enhance their adaptability to diverse environments through participation in multicultural activities. This approach enables them to provide more personalized services for international students, thereby significantly improving their management efficiency and facilitating cross-cultural communication.

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# A Metaphorological Interpretation of the Educator Spirit and Its Practical Function

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**Abstract:** This article, based on the realization of the Chinese Dream of the great rejuvenation of the Chinese nation, comprehensively expounds from six aspects what constitutes the unique spirit of an educator in China. To deepen the understanding of the meaning of the spirit of educators, based on the theory of metaphor, the author intends to construct a metaphor for the spirit of educators. By grasping the important discourse on education by leaders, educational works, authoritative public news and other text collections, the author aims to appreciate the traditional culture of the teaching profession and the background of the construction of the teaching staff in the new era. Combined with practical experience and the intuition of scholars, Specific meanings such as “anchor” and “beacon” were selected from the source domain, and the “six major metaphors” were constructed strictly in accordance with the principle of system mapping, with the aim of providing a new perspective for understanding and promoting the spirit of educators.

**Keywords:** The spirit of educators; Metaphorical interpretation; Practical function

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## 1. Introduction

To deliver education that satisfies the people, it is essential to clarify within our spiritual lineage “what spirit should guide educational development.” The educator spirit embodies not only the values and character upheld by outstanding teachers, highlighting the sacred nature of education, but also serves as a guiding force in the construction of an education powerhouse. It represents a refined and distinctive expression of Chinese discourse. To advance the initiative of cultivating the educator spirit and strengthening the teaching force, it is crucial for both teachers and the public to grasp its unique connotations. The key to such understanding lies in “language.” In his important discourses on education, the General Secretary employed expressions such as “posting challenges and appointing champions” and “fastening the first button of life correctly,” illustrating how metaphor allows educational theory to both “rise to the level of abstraction” and “remain grounded in practice”

<sup>[1]</sup>. The “educator spirit metaphor,” constructed on the foundation of metaphor theory, uses vivid imagery and systematic mapping to convey the rich connotations of this spirit in an accessible and publicly resonant manner—



making profound ideas both relatable and tangible. This approach offers a unique perspective for interpreting the educator spirit. Through this framework, teachers and the public can more effectively participate in all aspects of the campaign to promote the educator spirit and enhance the teaching profession. The goal is to distill, elevate, and harness the powerful energy of this spirit to advance the development of a high-quality, professional teaching force in the new era, thereby solidifying the foundation for building an education powerhouse <sup>[2,3]</sup>.

## **2. Metaphorical basis for interpreting the educator spirit**

### **2.1. The concept and characteristics of metaphor**

Metaphor is a form of non-literal expression <sup>[4]</sup>. Following the publication of “Metaphors We Live By” by linguist Lakoff and philosopher Johnson in 1980, conceptual metaphor theory was refined and expanded by numerous scholars in cognitive linguistics, stimulating extensive academic discourse <sup>[5]</sup>. This led to a broader understanding of metaphor as a phenomenon that transcends mere linguistic expression. It is recognized as a cognitive mechanism—a conceptual way through which humans comprehend the world. The historical significance of metaphors lies in their reflection of the modes of thought and worldviews characteristic of specific periods. Greater attention should be directed toward the role of imaginative wholeness in conceptual construction—beyond the precise definition and generative mechanisms of metaphors. From a conceptual perspective, the metaphorical method involves using “this thing” to signify “that thing,” where the two share intrinsic connections and similar attributes <sup>[6]</sup>. In conceptual metaphor theory, “this thing,” “that thing,” and “the connection” correspond to the source domain, target domain, and the cross-domain systematic mapping, respectively. Metaphorical thinking represents one of humanity’s fundamental ways of understanding the world. Within rhetoric, metaphors operate through figurative reasoning and comparison on a conceptual basis. They facilitate knowledge transfer, enhance linguistic expression, and strengthen cognitive and interpretive capacities, ultimately serving the persuasive aims of rhetoric <sup>[7]</sup>.

The figurative expressions emphasized in metaphorical discourse arise from the intrinsic relationship between similarity and mapping. Depending on how this relationship is manifested, metaphors exhibit two key characteristics: systematicity and coherence. On the one hand, metaphors are systematic. This systematic nature is a fundamental attribute of metaphorical concepts themselves; hence, the linguistic expressions that elaborate these concepts must also be systematic. People employ structured linguistic expressions to reflect the essential patterns of cognitive concepts. On the other hand, metaphors exhibit coherence. This is primarily reflected in the consistency between a metaphor and its cultural context, whereby the metaphor transfers the cultural values embedded in the source domain concepts. Embodied philosophy suggests that human conceptual systems and modes of thought are grounded in experiences within natural and social environments, which exhibit substantial commonalities <sup>[8]</sup>.

Thus, the construction of metaphorical meaning provides the key to understanding dual referentiality. The insufficiency of literal interpretation prompts the emergence of metaphorical meaning. In this process, the logical foundation of conceptual metaphor lies in humans’ continuous acquisition of experience through bodily perception, interaction with the environment, and sensory engagement. This gives rise to metaphorical thinking, which in turn generates subjectively nuanced metaphorical expressions. Therefore, the subjective agency of humans must be central to this process.

### **2.2. Metaphor analysis in education**

First, metaphors are widely employed in educational contexts to clarify instructional content and assist learners

in constructing accurate cognitive frameworks. As stated in “The Book of Rites • Xue Ji”: “The teaching of the noble man is through metaphor”. Metaphors used in curriculum and teaching possess significant pedagogical value: they stimulate student interest, improve comprehension of subject matter, foster moral education, and bridge the sciences and humanities. This pedagogical application of metaphor extends across all disciplines. Through metaphors, educators transform abstract ideas or disciplinary concepts into tangible images or actions, thereby building a “bridge” for intellectual exchange between teachers and learners.

Additionally, teacher image metaphors—which tend to function as “attribute metaphors”—represent a classical application of metaphor in education. These metaphors reflect societal consensus and cultural symbols associated with the image of teachers, embodying social expectations and psychological identification with the teacher’s role and position. They constitute a form of spiritual wealth and life philosophy accumulated through long-term historical and cultural development <sup>[9]</sup>. Dominant teacher metaphors shape educators’ beliefs, which in turn affect their teaching methods. Metaphors applied to educational elements, such as curriculum content, teacher-student relationships, and instructional materials, also reveal teachers’ pedagogical attitudes and convictions. Educators are, first and foremost, teachers whose professional identity requires them to be both producers and transmitters of knowledge <sup>[10]</sup>. Those who embody and continually practice the spirit of an educator can truly grow into the role. Given this relationship, the metaphorical image of teachers can serve as a crucial reference for interpreting the essence of the educator spirit, and metaphor itself can function as a theoretical method for elucidating its meaning.

### **2.3. Constituent elements of the educator spirit metaphor**

Analyzing the constituent elements and systemic relationships of the metaphor of educator spirit is essential for correctly interpreting its connotations through metaphor theory.

First, the source domain is a collection of conceptual domains used to metaphorically represent the educator spirit. It constructs semantic connections through literal entities and their extended meanings, linking them to existing cognitive experiences. As previously noted, metaphor as a rhetorical device ultimately aims to “persuade,” meaning the source domain must constitute a conceptual field formed by the target audience’s existing experiences, beliefs, and familiar concrete entities. As a vessel for meaning, metaphor cannot exist independently of context or the speaker. The source domain of the educator spirit metaphor also originates from embodied interactions within complex social and cultural structures, carrying cultural beliefs and values. Therefore, when depicting the educator image through metaphor, one should avoid negative cultural symbols from the source domain that may reinforce stereotypes, instead creating a novel and poetic discourse system.

Second, the target domain is the object requiring interpretation—the abstract encapsulation of the educator spirit. It constitutes a conceptual field composed of unfamiliar, collective ideas about the educator spirit, representing the “complexity” component of the structure. The educator spirit is rooted in national soil, embodying national character. It is the spiritual fruit formed through the fusion and collision of educational thought across past, present, and future generations, permeated with educational consensus from different eras. It manifests not only in educational practices but also in the non-rational dimensions of educational phenomena—such as personality traits, psychological dispositions, aesthetic sensibilities, value systems, and behavioral patterns. The target domain of the educator spirit encompasses the collective educational practices, conceptual frameworks, and cultural dimensions of educators within a cultural context. It embodies the inherent spiritual ethos and humanistic power projected by the educator spirit onto educational phenomena themselves.

Finally, systemic mapping serves as the pivotal connecting unit within the metaphor of the educator spirit.

Based on similarities between the source domain and target domain, it expresses a relatively less explicit meaning through a comparable concrete reality and its extended connotations, thereby designating one thing as another<sup>[11]</sup>. The specific context of the education spirit metaphor must reveal a systematic mapping process. The connections in this mapping can be direct, extended meanings, or action-based associations. It uses concrete, explicit, and expansive content familiar to the public to map relatively abstract and ambiguous characteristics. In this mapping process, the source domain content is more easily understood than the target domain concept requiring interpretation, creating a sense of “intuitive grasp.” This exemplifies the metaphorical function of language in expressing ideas and concepts.

### **3. A metaphorical interpretation of the educator spirit**

From the perspective of realizing the Chinese Dream of national rejuvenation and building a “dream team” of dream-makers for the Chinese nation, General Secretary Xi Jinping provided a concise, logical, and systematic elaboration of the essence of China’s unique educator spirit across six dimensions. This exposition not only fully acknowledges the contributions of educators to national revitalization but also reflects the high priority placed by the state on education, serving as a powerful source of inspiration and motivation for educators. To deepen the understanding of the educator spirit, this paper constructs a metaphorical framework based on metaphor theory. Thus, by analyzing the General Secretary’s important discourses on education, educational treatises, and authoritative public news texts, we grasp both the traditional culture of the teaching profession and the context of building a teaching force for the new era. Integrating practical experience with scholarly intuition, we selected concrete images such as “anchor” and “beacon” from the source domain. Adhering strictly to the principle of systematic mapping, we constructed “six major metaphors” to offer new perspectives for understanding and promoting the educator spirit.

#### **3.1. The anchor metaphor: An ideal of serving the greater good and dedicating oneself to the nation**

“The educator spirit is akin to a ship’s anchor, mooring educators’ steadfast belief in diligently cultivating the educational field and grounding their hearts in the nation. It motivates them to fulfill the historical mission and the trust of our time bestowed upon all teachers by the Party and the people, establishing the lofty aspiration that education serves as a driving force for social progress and national rejuvenation.”

The “anchor” is a metaphorical image commonly associated with stability, security, steadfastness, and loyalty. By securing a ship’s position, an anchor prevents drifting or loss of control. Across global literature and cultural contexts, the anchor often symbolizes resoluteness and stability. It reflects the core values deeply embedded within one’s heart, resisting external pressures through firm belief to stay on course. The “anchor metaphor” draws from the source domain of the anchor to represent the target domain of the educator spirit—namely, “an ideal of serving the greater good and dedicating oneself to the nation.” It illustrates that the work of education is like sailing a ship through waves: while pursuing lofty ideals, educators must also shoulder their responsibilities and anchor their aspirations with unwavering conviction. The concept of the “career anchor,” introduced by renowned psychologist and organizational management scholar Edgar H. Schein, uses the anchor metaphor to signify the essential values or principles that individuals refuse to compromise when making career choices<sup>[12]</sup>.

### **3.2. The beacon metaphor: Moral integrity that exemplifies scholarly conduct and sets a model for society**

“The educator spirit is a beacon that ignites moral flame through noble aspirations and conduct. It embodies the inner quality of self-cultivation through tranquility, radiating the principle that ‘when one’s conduct is upright, no orders are necessary.’ It guides students through life’s uncertainties and illuminates their path forward.”

The “beacon” is a common yet profoundly meaningful metaphor. In Buddhism, it symbolizes light and wisdom. The “beacon metaphor” employs the source domain of the beacon to represent the educator spirit in the target domain—namely, “moral integrity that exemplifies scholarly conduct and sets a model for society.” This reflects how educators, much like beacons, cultivate virtue within and radiate brilliance outwardly.

Many Western thinkers have also drawn on the extended meanings of “light” or “illumination” associated with the beacon to articulate profound educational insights. Herbart, focusing on educational guidance, emphasized that instruction should ignite the “second spark” through the “first spark”<sup>[13]</sup>. Sukhomlinsky likened teachers to “guiding lights,” describing them as not only the “first” but also the “principal” beacon in students’ intellectual lives<sup>[14]</sup>. Diesterweg compared teachers to “torches,” arguing that educators must become “the true torch of reason and enlightenment”<sup>[15]</sup>.

### **3.3. The seedling nurturing metaphor: Educational wisdom that enlightens minds, nurtures hearts, and tailors instruction to individual aptitudes**

“The essence of the educator spirit lies in the devoted nurturing of seedlings. With pedagogical wisdom, educators foster young minds, applying tailored approaches according to each seedling’s unique characteristics. They enlighten intellect and cultivate character, enabling these seedlings to grow into ‘fine timber’ and ‘blossoming flowers’ that enhance our nation’s magnificent landscape.”

The “seedling nurturing” metaphor embodies profound pedagogical wisdom and reflects an educational philosophy centered on attentive and individualized nurturing. As General Secretary Xi Jinping emphasized, educating children is akin to planting trees: they must be guided upright from the beginning to prevent crooked growth<sup>[16]</sup>. Ye Shengtao observed that education is not akin to industrial manufacturing but rather resembles the careful, deliberate work of traditional agriculture. Teaching and nurturing are not about mass-producing uniform outputs; instead, they are comparable to a farmer sowing seeds and tending to seedlings. This process requires setting appropriate educational goals, selecting suitable content, and applying fitting methods to promote students’ holistic development<sup>[17]</sup>. Dewey advocated that “education is growth,” positing that children possess both plasticity and an innate, proactive capacity for development<sup>[18]</sup>. The “seedling nurturing” metaphor underscores the distinctive wisdom educators exercise in cultivating talent. It entails creating optimal environmental conditions and providing fertile ground for growth based on each “seedling’s” developmental patterns, using scientifically informed methods to support student development. This pedagogical wisdom is rooted in solid scholarship and profound reflective practice, nourished by deep disciplinary knowledge and strong teaching competence. With a comprehensive understanding of both subject matter and student individuality, educators—guided by a macro perspective that connects historical insight with contemporary relevance and future vision—foster a learning environment rich in inspiration and innovation.

### **3.4. The canal-digging metaphor: A diligent, steadfast, truth-seeking, and innovative approach to scholarly pursuit**

“The educator spirit is akin to digging a canal with one’s own hands—it requires ‘personally wading into the



river to gauge its depth’ and diligently seeking truth to uncover educational insights. It entails adhering to facts and grounding one’s work in reality, while also adopting an innovative mindset to ‘draw in fresh water to nourish education,’ thereby sparking educational inspiration and boldly pursuing change.”

The “canal-digging metaphor” employs action-oriented imagery, necessitating an analysis of both the action itself and its purpose to fully grasp the metaphorical mapping. “Digging” refers to the physical act of carving out a channel with tools such as hammers and chisels, with the ultimate goal of enabling water to flow. This process demands hands-on involvement and steadfast perseverance. The metaphor maps the action of “digging” from the source domain onto the target domain of “the essence of learning lies in practice,” while its purpose implicitly conveys the innovative spirit encapsulated in the notion of “fresh water”—that is, “transforming the old and actively pursuing renewal.” This aligns with the “diligent, steadfast, truth-seeking, and innovative approach to scholarly pursuit.”

“The new era must harness innovation to fuel the momentum of civilizational development and activate the fresh waters that sustain its progress” <sup>[19]</sup>. Thus, educators must become pragmatic pioneers who carve out channels of dedicated teaching and channel the fresh waters of scholarly innovation. From the symbolic significance of hydraulic engineering projects such as the Ling Canal and the Red Flag Canal in history and culture, innovation and perseverance, life and hope have come to form the spiritual foundation of the “canal-digging metaphor.” As the saying goes, “ask the canal how it remains so clear—it is because fresh water flows from its source.” The “canal-digging metaphor” embodies a practical attitude of steadfast commitment to the teaching profession, seeking truth through pragmatic means, and pursuing bold innovation. Learning must be a continuous pursuit.

### **3.5. The chalk metaphor: A benevolent heart that finds joy in teaching and devotion to students**

“The educator spirit is like chalk: it inscribes educational knowledge, outlines the joy of teaching, conveys profound dedication to instruction and deep care for students, and embodies selfless devotion to education. It regards education as both a lifelong vocation and a perpetual pursuit.”

Chalk is an everyday object, familiar, tangible, and functional, designed to be consumed in the act of writing. Mapping chalk from the source domain to the target domain of “educator spirit,” a benevolent heart that finds joy in teaching and devotion to students, facilitates a contextual understanding through metaphorical extension, grounded in the systematic nature of metaphor theory. Writing educational knowledge represents the “life” of chalk; its “mission” is to devote itself entirely to education. Educators who treat teaching as their mission do so out of genuine love for education, transcending utilitarian motives and artificial gestures.

Gray hair weaves through days and nights, while silent chalk writes the seasons. The “chalk metaphor” conveys a spirit of untiring dedication and wholehearted commitment—one that fulfills personal value and leaves a lasting educational legacy. “Dedication,” however, should not be mistaken for blind sacrifice. Teachers must nurture the motivation and sentiment behind dedication, anchoring it in love and responsibility as its emotional foundation. Benevolence, a core virtue in Chinese tradition and an enduring ethos of teaching, emphasizes “enriching oneself to benefit others through selfless contribution” and “awakening souls with one’s spirit, nourishing hearts with one’s mind” <sup>[20]</sup>.

### **3.6. The ocean metaphor: A commitment to enlightening others through culture with a global vision**

“The educator spirit is like a vast ocean, nurturing global civilizations with boundless compassion. It advances



the progress of education worldwide through waves of humanistic values, making education the current that connects human societies and carries forward our shared values.”

The ocean is boundless—not only does it carry ships upon its surface, but it also fosters diverse life and matter within its depths, symbolizing profound inclusiveness and infinite depth. The pursuit of “enlightening others through culture with a global vision” reflects the global vision of the Chinese nation, rooted in the inheritance of its excellent traditional culture. It underscores educators’ firm cultural confidence and noble aspiration to advance human civilization, addressing from a macro perspective the essential question: “What should teachers strive for?”<sup>[21]</sup> “Scholars value broad learning above all.” Educators must develop extensive knowledge and a magnanimous spirit to guide students toward becoming well-rounded individuals. They should embrace all like the ocean, possessing not only the breadth of mind to uphold the nation’s grand ambitions, but also the steadfast dedication to deepen their learning and shoulder the profound mission of nurturing future generations. The “ocean metaphor” conveys that neither the raging waves of historical upheavals nor the turbulent undercurrents of global changes can shake educators’ unwavering resolve to advance against the current and cultivate humanity through the pursuit of truth and virtue.

## **4. The practical function of the educator spirit metaphor**

### **4.1. The symbolic expression of metaphor facilitates recognition of the implications of educator spirit**

Humanistic knowledge is inherently metaphorical, meaning that expressions of life’s meaning typically proceed not through logical or empirical means, but through “metaphor”—a mode that is neither strictly logical nor empirical. Without metaphor, humanistic knowledge becomes ineffable<sup>[22]</sup>. This is especially relevant for primary and middle school teachers, for whom grasping the essence of educator spirit involves a dual challenge: a lack of cultural imagination and a shortfall in embodied cognition. The metaphor of educator spirit acts like a lever—prying open the understanding of humanistic knowledge, making it articulate, tangible, and actionable.

On the one hand, the metaphor of educator spirit visualizes language conveyed through text and sound, achieving a synesthetic transfer from the source domain to the target domain. This enhances the “audiovisual integration” of cultural imagination and lowers the threshold for comprehending the target domain. By evoking different facets of the educator spirit, the metaphor establishes resemblances with events teachers have experienced or phenomena they have perceived. These resemblances may be external and formal, or internal and conceptual. Through the mapping of specific forms and content from the source domain onto the target domain, metaphorical descriptions endow the abstract concept of educator spirit with perceptible form, opening alternative avenues for its comprehension.

On the other hand, the metaphor of the educator spirit represents an indirect mode of comprehension. Rooted in inspiration, imagination, and perception, it constitutes a system of interpretation built upon the listener’s embodied experience and cognitive condition. Unlike logical-positivist understanding, this metaphorical approach depends more fundamentally on the teacher’s judicious selection of source domain content, which in turn relies on contexts drawn from life experience. Using vivid metaphors to convey the educator spirit serves to transduce its abstract attributes into transferable semantic form. Because teachers can construct systematic mappings through divergent imagination grounded in embodied experience, and because listeners generate meaning through their own imaginative engagement, the metaphor of educator spirit employs well-chosen source domain concepts. It transforms logical, abstract, and generalized notions via figurative interpretation from the

source domain. Mediated by the teacher's imagination, this process enriches the understanding of educator's spirit with contextual, concrete, and perceptible content.

## **4.2. The metaphorical imagery of educator spirit shapes its value leadership**

Objectively speaking, metaphor serves as an informal cultural expression that reflects people's unique perspectives on things while also embodying collective judgments and evaluations. The construction of the educator spirit metaphor encapsulates the demands, expectations, and recognition that society places upon educators in this era. It establishes the value leadership of the educator spirit primarily by shaping external perceptions of the ideal educator spirit and stimulating internal self-reflection among teachers. This process contributes to conveying compelling narratives of Chinese educators and fostering a social atmosphere that respects teachers and values education.

To a certain extent, the metaphor of educator spirit represents a social consensus on the image of educators. It embodies societal expectations and psychological identification with the role and social positioning of educators, functioning as a type of educational-cultural symbol. Within the conceptual domain shaped by long-term historical and cultural accumulation, the educator spirit evolves alongside social changes, reflecting each era's vision of the ideal teacher's character. The cultural symbolism embedded in this metaphor enriches the expression of the educator spirit, conveying societal expectations for teachers' moral qualities while shaping their professional image. By establishing the conceptual domain of this spirit, traits such as patience, responsibility, respect, tolerance, tailored instruction, and unwavering dedication are further externalized. As a cognitive facilitation mechanism, the metaphor of educator spirit underscores the noble moral sentiments of educators, emphasizing dedication and devotion. It helps shape an educator image that aligns with contemporary societal expectations, thereby strengthening the development of a high-quality, professional teaching workforce in the new era.

The external manifestation of metaphor also opens pathways for teachers to gain insight into practical knowledge and restore pedagogical imagery through reflection, adding a new dimension to their professional awareness<sup>[23]</sup>. From this perspective, the metaphor of educator spirit inherently carries practical guidance on how teachers should treat students, approach knowledge, and engage with their own practice. The pursuit of purity and supreme virtue within this metaphor constitutes the foundation of teaching, encouraging teachers to engage in introspective practice and achieve self-image formation. A positive and virtuous image serves both as an intrinsic spiritual need for self-preservation and as an endogenous driver for self-development<sup>[24]</sup>. The educator spirit metaphor helps shape the positive image of the "exemplary teacher of a great nation," providing an internal motivator for self-reflection and a benchmark for professional growth.

## **5. Conclusion**

Overall, as a discursive form, metaphors of the educator spirit establish connections between source-domain and target-domain concepts through a deliberate "deviation" in the original meaning of words. This systematic mapping, neither wholly identical yet strikingly analogous—provides a method for grasping abstract concepts. However, when interpreting such metaphors, one must avoid exaggerating interpretive gaps. For instance, misreading the "chalk metaphor" as implying the "objectification of teachers" would distort the original intent behind the metaphor. Instead, we should utilize the educator spirit metaphor to comprehend unfamiliar, abstract concepts in the target domain through familiar, concrete elements from the source domain. Simultaneously, the

educator spirit should serve as a cognitive framework for self-reflection, helping to establish a developmental coordinate system for high-quality, professional teachers via the concrete imagery evoked by the metaphor. This approach promotes the understanding and promotion of the educator spirit, injecting spiritual strength into the initiative of forging the soul and empowering teachers in the new era.

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# Training Mode of School-Enterprise Cooperation and Collaborative Education in the Major of Information and Computational Science

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**Abstract:** School-Enterprise cooperation represents a relatively modern and innovative model for talent education and training. By using the theory of hierarchical teaching, students are classified according to industry demands, ensuring targeted and practical development. Taking the Information and Computational Science major at Dalian Minzu University as a case study, this paper provides a detailed exploration of the collaborative education and training model fostered through School-Enterprise partnerships. It is hoped that the insights and experiences shared herein can offer valuable reference and support for the advancement of similar programs at other higher education institutions.

**Keywords:** School-enterprise cooperation; Collaborative education; Innovation training

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## 1. Introduction

Through the investigation and analysis of the data of the talent market and the employment destination of graduates, it is found that the demand for talents majoring in information and computational science (hereinafter referred to as information science) is still very large<sup>[1]</sup>. With the development of the economy and society, scientific research institutes, the information industry, banking, securities, finance, and other industries need a large number of application-oriented talents specializing in information technology. In particular, in some high-tech fields, there is an urgent need for high-level applied talents who have solid mathematical backgrounds. These professionals must master the fundamental theories, methods, and skills of information science, computer science, economics, and financial mathematics to effectively solve complex practical problems<sup>[2-5]</sup>.

Due to the expansion of university enrollment and shifts in enrollment policies, the overall academic foundation of students has weakened, resulting in significant performance disparities among students from different provinces of China. This poses substantial challenges for university education. Furthermore, many students struggle to adapt to the new pedagogical methods, often exhibiting poor learning attitudes and a lack of clear academic goals. The diversification of career paths further complicates the teaching landscape.



Consequently, the traditional curriculum system can no longer meet the needs of cultivating applied talents with strong social adaptability and employment competitiveness. This misalignment has led to a paradoxical situation: while the market urgently demands skilled professionals, many graduates remain unemployed due to high industry skill requirements and fierce market competition. Therefore, it is imperative to change from passive acceptance to active adaptation, to actively adapt to the demand for talent in the market. To bridge this gap, a shift from passive acceptance to active adaptation is imperative. Therefore, researching innovative training models for Information Science professionals has become a top priority. Such research is not only an inevitable trend in higher education reform but also an urgent necessity driven by socio-economic development.

Meanwhile, the training model of School-Enterprise cooperation provides substantial support for the healthy development of higher education institutions. As a relatively modern education and training model, it has been successfully implemented for many years in developed countries across Europe and the United States <sup>[2-4]</sup>. Practice has proved that this approach acts as a catalyst for mutual growth, injecting vitality into both academic and industrial sectors. Specifically, it assists universities in addressing the scarcity of educational resources and bridging the gap between academic instruction and practical production needs. Simultaneously, it cultivates development-oriented talent tailored to the specific requirements of enterprises, fostering their long-term advancement.

However, a fundamental and robust training model for school-enterprise cooperative education has yet to be fully established. Currently, collaboration remains characterized as ‘hot in schools but cold in enterprises,’ often existing in a state of shallowness, looseness, and low-level engagement <sup>[5]</sup>. The enthusiasm of enterprises to participate in talent cultivation remains low, resulting in a significant disconnection between curriculum content and professional standards. Consequently, the issue of ‘emphasizing theory while despising practice’ remains pervasive within most application-oriented universities.

In this paper, we mainly focus on solving the following three research questions:

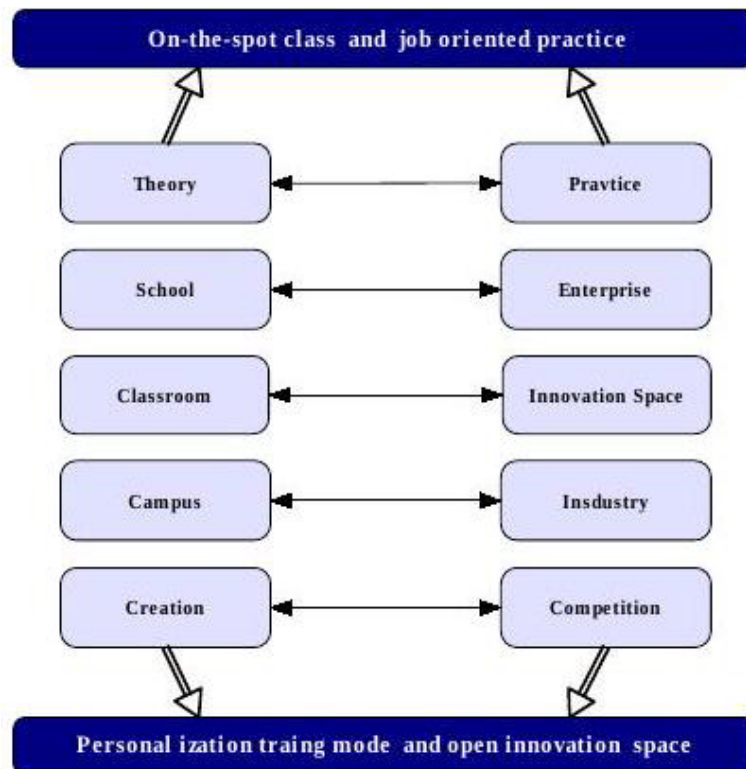
- (1) RQ1 How to deepen the breadth and depth of industry-education integration projects aimed at a stable double-qualified teaching staff and more practice training base outside the school?
- (2) RQ2 How to guarantee the enterprises’ practical benefits from the integration of production and education, and improve their participation enthusiasm?
- (3) RQ3 How to fully utilize the high-quality resources of enterprises and benefit more teachers and students from different majors and educational background?

The study employed a mixed-methods research design, incorporating both quantitative and qualitative data collection and analysis techniques.

## 2. Innovation-oriented training mode

According to the sorting teaching theory and the need for the development of the information science major and the cultivation of talents, we sort the students of this major into two categories: the postgraduate entrance examination improvement class and the broadening application class (**Figure 1**).

Broadening the applied students is mainly based on the training model of School-Enterprise cooperation, while this approach is mainly aimed at students who have a weak foundation in mathematics but can use the mathematical knowledge they have learned and proficient computer skills to solve practical problems. Since 2018, the university, in collaboration with partner enterprises including Tentact Dalian and SV Insight, has jointly recruited students for the ‘Intelligent Software Development’ program. Those enterprises are known as a human resource service organization under Dalian Software Park and the Chengdu High-tech zone. Numerous



**Figure 1.** Training mode for the talent students.

other well-known enterprises are also introduced to the university. Taking Sino-soft as an example, it operates as a professional training institution for university students, which specializes in fields including software development, integrated circuits, the Internet of Things, embedded systems, and embedded service outsourcing.

We adopted a “learning-training-relearning-retraining” model during the implementation of School-Enterprise cooperation. That is, after the students complete the course, they will have a semester of training at the end of the semester. With the accumulation of professional knowledge, the difficulty of the actual project of the semester training also increases. Following the completion of enterprise training, students proceeded to on-the-job internships where they undertook their graduation projects. This phase enabled them to gradually develop the core competencies required of software development engineers, including communication skills, the ability to solve problems using professional knowledge, project management and organization, teamwork, practical English proficiency, and capabilities in innovation and entrepreneurship. The cooperation with SV light training is based on the first start in 2021, and it has recruited 30 students in the direction of software development and blockchain security with an increasing trend.

## 2.1. Professional training model oriented to industrial needs

For the cooperative major, Tentact Dalian has collaborated with Dalian Minzu University to formulate a specialized talent training program and a teaching operation plan, aligning the curriculum with the specific demands of the industry and enterprises.

The program adopts a ‘2.5 + 1.5’ cooperative education mechanism.

(1) Phase 1 (Semesters 1–5): During the first five semesters, students remain on the university campus to

complete foundational and professional core courses. While the primary instruction is delivered by the university's faculty, the partner enterprise supports this phase by providing teacher training, online educational platforms, and technical experts to enhance students' practical and hands-on skills.

- (2) Phase 2 (Semester 6): In the sixth semester, students transition to the enterprise training base to complete advanced professional theory courses and laboratory experiments.
- (3) Phase 3 (Semester 7): At the beginning of the seventh semester, students engage in practical training at the enterprise's training base, working on enterprise-level development projects. This phase is conducted concurrently with the completion of their graduation design (thesis), ensuring the research is grounded in real-world application.
- (4) Phase 4 (Semester 8): The enterprise is responsible for the internship of students entering the enterprise, and the students complete the graduation project (thesis) under the joint guidance of teachers from both sides.

The primary objective of practical teaching is to reinforce theoretical mathematical knowledge and cultivate students' ability to solve real-world problems through diverse experiential components. It is an indispensable element in the cultivation of applied talents. The practical teaching system for the Information and Computational Science major is comprehensive, encompassing curriculum-based practical training, professional practice (including graduation projects and internships), social practice, and employment guidance activities.

## **2.2. Further optimization of the practical teaching system**

On the basis of the original training model cooperated with IT enterprises, we actively carry out inquiry-based practical teaching and establish and open mathematics laboratories. Through seminar-based teaching, open-ended, and problem-based homework training, students will be trained to use mathematical knowledge to solve practical problems. In addition, the second class is actively carried out, especially the mathematical modeling competition and mathematical modeling training, so that the students' mathematical thinking ability, mathematical application ability, and innovation ability to solve practical problems can be improved.

The training is responsible for the implementation of students' employment, and ensures that at least 3 jobs are provided for each student with employment needs, except for those who are admitted to graduate school. Both sides cooperate to guarantee that of students will enter the work of large and medium-sized software enterprises in China after graduation, and ensure that the employment rate of qualified graduates will reach more than 90%.

The direction of intelligent software development is directly oriented to the application and design direction of the industry, and the traditional faculty construction mode is easy to be out of touch with the practice of the industry, which affects the quality of talent training. Enterprise training regularly provides case teaching and practical training courses for teachers in our school, and faculty teachers are encouraged to enter enterprises for short-term engineering practice in a planned way, so that teachers can continuously consolidate and update their professional knowledge, and grasp the cutting-edge trends of the industry by participating in the actual projects of enterprises.

## **2.3. Reform and innovation of teaching methods**

Following the concept of characteristic major construction, we adopt a combination of heuristic and inquiry-based teaching methods to inspire students' wisdom. The combination of case-based and seminar-based teaching methods is adopted to cultivate students' ability to analyze and solve problems.

We adopted a student-centered approach in this model. It deepens the reform of classroom teaching

methodologies through the following strategies:

- (1) Fostering Independent Learning: Implementing a blended approach of self-study and instructor guidance to promote autonomous learning.
- (2) Inspiring Critical Thinking: Utilizing heuristic and inquiry-based methods to stimulate intellectual curiosity and insight.
- (3) Developing Problem-Solving Skills: Employing case-based and seminar-style instruction to enhance students' abilities to analyze and resolve complex issues.

Furthermore, the curriculum extends beyond the traditional classroom through lectures, extracurricular activities, and participation in science and technology competitions to cultivate well-rounded competencies.

### 3. Identifying contributing features

To gain deeper insights into experiences and attitudes toward School-Enterprise cooperation, we conducted semi-structured interviews with a subset of participants who opted-in for the follow-up interview. The interviews were approximately 25–30 minutes long and used open-ended questions to encourage participants to share their perspectives freely. The interview responses were recorded and later transcribed for analysis. Participants include lectures in the company, human resources who hired our graduates and the campus students, as well as those who have graduated.

Next, we delved into the process of identifying the key contributing features that influence the quality of School-Enterprise cooperation. To accomplish this, we employed regression analysis and utilized the LASSO (Least Absolute Shrinkage and Selection Operator) technique for feature selection. Through this analysis, we aimed to uncover the most significant factors that play a role in shaping educators' attitudes in order of importance.

The analysis yielded a list of features along with their corresponding coefficients, shedding light on the relative impact of each feature. **Table 1** shows the most important factors that influence teacher's sentiment about Generative AI, listed in ranked order.

**Table 1.** Top 5 factors affecting the quality of school-enterprise cooperation

Rank	Factor	Effect
1	Improvement of application ability	Positive
2	Encouragement of different kinds of employment	Positive
3	Interests of enterprises are guaranteed	Positive
4	Decreases critical thinking	Negative
5	Increase cheating and dishonesty	Negative

It is evident that factors related to application ability, Encouragement of different kinds of employment, and Interests of enterprises are guaranteed to be among the most influential in shaping positive attitudes. Conversely, concerns about loss of creativity and potential for cheating and dishonesty negatively impact attitudes.

Moreover, we extended our analysis to different regression techniques, including Linear Regression, Random Forest, Gradient Boost, and XGBoost. The mean squared errors (MSE) obtained ranged between 0.4 and 0.5, indicating a reasonable level of predictive accuracy using these features.

Overall, our analysis unveils a hierarchy of factors that significantly contribute to School-Enterprises cooperation attitudes. These insights can guide similar majors in China's universities in understanding the intricate interplay of factors that shape attitudes, thereby facilitating informed decision-making and effective implementation strategies.

## 4. Conclusion

The development of the School-Enterprise cooperative education model represents a significant pedagogical reform implemented on university campuses. It is currently one of the key developmental strategies for local higher education institutions in China and reflects a global trend in the evolution of modern universities. It is hoped that the insights and experiences shared in this paper can offer valuable reference and support for the advancement of similar programs at other higher education institutions.

## Disclosure statement

The authors declare no conflict of interest.

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# Research on Reform Ideas and Promotion Strategies for Labor Education in Higher Education

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**Abstract:** In the context of the 2new era, labor education, as an important component of the theoretical system of socialist education with Chinese characteristics, has been officially incorporated into the Party's educational policy. This article aims to explore the role, implementation priorities, challenges in promotion, and improvement strategies of labor education in higher education. Through literature review and empirical research, this article analyzes the importance of labor education in promoting the comprehensive development of students and enhancing the quality of higher education, and proposes specific implementation suggestions. The study finds that labor education not only cultivates students' practical abilities and innovative spirit but also helps them form a positive outlook on employment and entrepreneurship. However, labor education faces many challenges in its implementation, such as integrated layout, resource construction, integration of labor and education, and evaluation mechanisms. This article suggests that universities should strengthen the construction of labor education curriculum groups, develop a labor education checklist, and explore labor education demonstration positions to promote the effective implementation of labor education.

**Keywords:** Labor education; Practical ability; Innovative spirit; Reform strategy

**Online publication:** December 31, 2025

## 1. Introduction

When elaborating on the comprehensive development of human beings, Marx and Engels, the founders of Marxism, mentioned the importance of labor in this process. They believed that the essence of human beings lies in labor, and the comprehensive development of human beings requires the integration of mental and physical labor to achieve free and comprehensive development <sup>[1]</sup>. This theory provides an important theoretical basis for the implementation of labor education in higher education.

The document "Guidelines for Labor Education in Primary and Secondary Education (Trial)" issued by

the Ministry of Education proposes to strengthen the construction of the teaching staff, improve the funding mechanism, and enhance professional research and guidance. Clarify the management requirements for labor education teachers, ensure that they enjoy equal treatment with other full-time teachers, and promote teacher communication and sharing mechanisms. At the same time, higher education institutions should strengthen the training of labor education teachers, establish labor education-related majors where conditions permit, and incorporate labor education into various training contents to enhance labor education awareness<sup>[2]</sup>. The Opinions on Strengthening Labor Education in Primary and Secondary Schools in the New Era issued by the State Council put forward basic principles such as grasping the direction of education, following educational laws, reflecting the characteristics of the times, strengthening comprehensive implementation, and adapting to local conditions. It emphasizes that labor education is an important component of the national education system, with comprehensive educational value in cultivating morality, improving intelligence, enhancing physical fitness, and cultivating beauty<sup>[3]</sup>. The Ministry of Education's document "Guiding Outline for Labor Education in Primary, Secondary, and Higher Education (Trial)" proposes requirements for strengthening the construction of teacher teams, improving funding mechanisms, and enhancing professional research and guidance. It clarifies the management requirements for labor education teachers, ensures that they enjoy equal treatment with other full-time teachers, and promotes a mechanism for teacher exchange and sharing<sup>[3,4]</sup>.

At the same time, institutions of higher learning should strengthen the training of labor education teachers, establish relevant majors in labor education where conditions permit, and incorporate labor education into various training contents to enhance the consciousness of labor education. The "Opinions on Comprehensively Strengthening Labor Education in Primary, Secondary, and Higher Education in the New Era" issued by the State Council proposes basic principles such as grasping the direction of educating people, following the laws of education, reflecting the characteristics of the times, strengthening comprehensive implementation, and adhering to local conditions. It emphasizes that labor education is an important part of the national education system and has comprehensive educational value in cultivating morality, enhancing intelligence, strengthening physical fitness, and fostering beauty.

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With the deepening of educational reforms, universities are increasingly emphasizing students' all-round development, moving beyond mere knowledge transmission. Labor education, as an important pathway to promoting students' all-round development, has gradually gained attention and importance from universities. As society develops, the demand for talent is constantly changing. Modern society needs individuals with an

innovative spirit and practical abilities, and labor education can cultivate these abilities in students <sup>[7-9]</sup>. Therefore, the research background of labor education in higher education is closely related to societal needs.

University students are at a crucial stage of personal growth, facing issues such as career choices and life planning. Labor education can provide students with practical opportunities, helping them understand society and industries, improving their employability, and simultaneously promoting their personal growth and development.

In summary, the research background of labor education in higher education is multifaceted. It has a certain theoretical foundation, meets the needs of educational reform, and is closely related to social needs and student development. Higher education should fully recognize the importance of labor education and actively explore effective ways and methods to implement it to promote students' all-round development. Labor education plays a vital role in the reform of higher education teaching and learning; it not only promotes students' all-round development but also drives the overall improvement of higher education. Therefore, the role of labor education in the reform of higher education teaching and learning is crucial.

## **2. The role of labor education in higher education**

In higher education, the importance of labor education is becoming increasingly prominent. Labor education plays a crucial role in cultivating the all-round development of university students, exerting a subtle influence, particularly on their moral character, intellectual abilities, and physical fitness. Labor is the foundation of human survival and development; through labor education, students can cultivate positive qualities such as appreciating the fruits of labor, respecting the labor of others, and being grateful to society.

Labor education contributes to students' moral development and is crucial for college students to establish correct labor values. It not only cultivates students' love and respect for labor but also fully inspires their spirit of diligent work. Through labor education, students can deeply understand the hard work of laborers, thereby cultivating a good work ethic. This process has profound significance for realizing the Chinese Dream of the great rejuvenation of the Chinese nation <sup>[10]</sup>.

The comprehensiveness and integrated nature of labor education make it an important way to enhance college students' practical abilities, thinking skills, and adaptability. Through labor practice, students strengthen their logical thinking and improve their teamwork and organizational skills. Labor education promotes intellectual development, enabling students to test and deepen their theoretical knowledge in practice.

The functions of labor education in inheriting and innovating knowledge are listed: Through labor, specific skills and knowledge required by various industries can be inherited and innovated, laying a foundation for students' future career development. The role of continuing and guiding creative thinking: The process of labor requires continuous problem-solving and innovation, which plays an important role in cultivating students' creative thinking. Furthermore, the promotion of labor education in universities helps college students develop strong psychological qualities through experiencing hardship and sweating, and temper their will through arduous struggle and tenacious effort, thereby gaining valuable spiritual wealth that will benefit them throughout their lives; it also helps college students form a positive outlook on employment and entrepreneurship, finding a balance between national and social needs and the realization of personal value, and between professional learning and job matching, forming an independent and diversified positive employment perspective, and enhancing their entrepreneurial and innovative awareness and abilities.

In conclusion, labor education is an important component of higher education and is of great significance for students' all-around development and future career planning.

### 3. Key points, difficulties, and improvement strategies for implementing labor education

Implementing labor education in higher education institutions requires focusing on cultivating students' practical abilities and innovative spirit, conducting targeted labor education based on the characteristics of their majors, innovating teaching methods, improving the evaluation system, strengthening the teaching staff, and creating a positive campus culture.

#### 3.1. Integration into talent cultivation programs

According to the “Opinions of the CPC Central Committee and the State Council on Comprehensively Strengthening Labor Education in Primary and Secondary Schools in the New Era” issued in March 2020, and the “Guidelines for Labor Education in Primary and Secondary Schools (Trial)” formulated by the Ministry of Education in July 2020, it is emphasized that “labor education should be incorporated into the national curriculum for primary and secondary schools and the talent cultivation programs for vocational schools and regular universities, forming a comprehensive, practical, open, and targeted labor education curriculum system.” “Regular universities should incorporate labor education into their professional talent cultivation programs and clarify the main courses upon which it is based.”

**Table 1** shows the integration of labor education into talent cultivation programs at 68 universities. It can be seen that since 2019, the proportion of labor education in talent cultivation programs has been increasing year by year, and universities are gradually paying more attention to it. However, some problems exist, mainly the following: labor education has goals but lacks support; it has theory but lacks practice, failing to be integrated throughout the entire talent cultivation process. Therefore, integrating labor education into talent cultivation programs is one of the difficulties in its implementation.

**Table 1.** 68 universities' programs for integrating labor education into talent development

Time (Year)	Number of schools integrating talent development programs	Cumulative
Before 2019	14	21%
2019	5	28%
2020	17	53%
2021	25	90%
2022	7	100%
Total	68	100%

#### 3.2. Establishing compulsory labor education courses

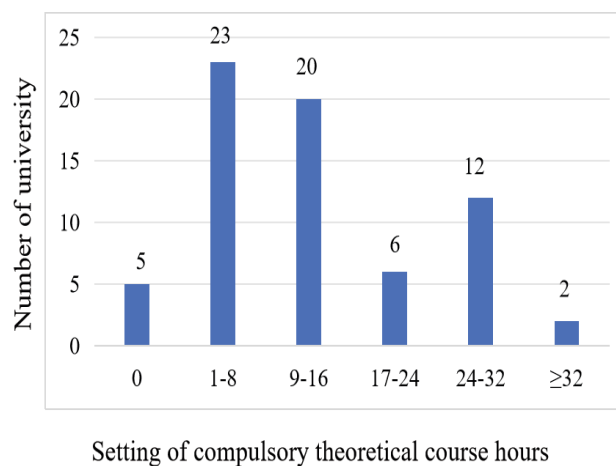
A comprehensive, practical, open, and targeted labor education curriculum system should be established. Compulsory labor education courses should be set up in primary, secondary, and tertiary schools according to the characteristics of each educational stage to systematically strengthen labor education. Schools must earnestly assume primary responsibility for labor education, clearly define the implementing institutions and personnel, and ensure that all labor education courses are offered.

Regular institutions of higher learning should clearly define the main courses upon which labor education should be based. They may establish dedicated labor education modules within existing curricula or offer compulsory labor education courses, with no less than 32 class hours at the undergraduate level. The course

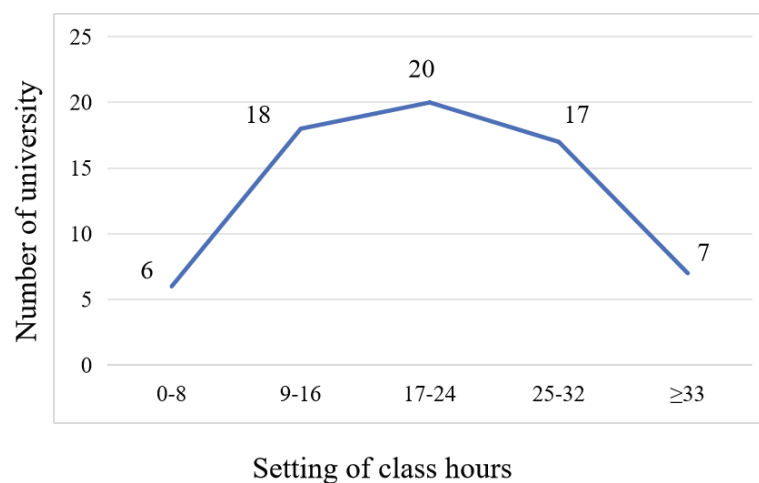
content should strengthen education on Marxist labor theory, popularize general labor science knowledge closely related to students' career development, and provide necessary practical experience.

Offering compulsory labor education courses is essential for clarifying and guaranteeing the status of labor education, a crucial means of implementing the new requirements for labor education in higher education in the new era, an inherent requirement for improving students' labor literacy, and currently an urgent and paramount task for labor education in higher education.

According to statistics, the allocation of theoretical and practical class hours for compulsory labor education courses in Shandong Province universities is shown in **Figure 1** and **Figure 2**, respectively. As can be seen from these two figures, in terms of theoretical class hours, 2 universities have more than 32 hours, 43 universities have less than 16 hours, and 5 universities have 0 hours; in terms of practical class hours, 6 universities have less than 8 hours, with most universities ranging from 9 to 32 hours. Overall, the allocation of class hours emphasizes practical application over theoretical application. The development of course quality standards needs to be strengthened; a few universities have adopted a purely online teaching format.



**Figure 1.** Statistical chart of the theoretical credit hours for compulsory labor education courses in universities in Shandong province.



**Figure 2.** Statistical chart of labor education practice hours set in colleges and universities in Shandong Province.



Analysis of the survey results reveals the following opinions and demands from university students regarding labor education: Labor courses lack rich content, are overly theoretical, and lack practical components; the didactic approach to labor education lacks appeal and interest; students experience a low level of satisfaction with current labor education and express a strong desire and expectation to participate in practical labor; they suggest enriching the implementation methods and channels of labor education to ensure its continuous integration into daily life; and they favor organizing labor-based activities such as career experiences and social practice exercises that take place outside the campus and into the real world of work, grounded in authentic labor scenarios.

### **3.3. Implementing labor education week**

Primary, secondary, and tertiary schools shall establish a Labor Week each academic year, which may be arranged independently within the academic year or during winter and summer vacations, with collective labor as the main activity. Universities may also arrange a Labor Month to centrally implement the requirements of the Labor Week for each academic year. To effectively organize and implement Labor Week, universities should organize students to go out into society and focus on off-campus labor training.

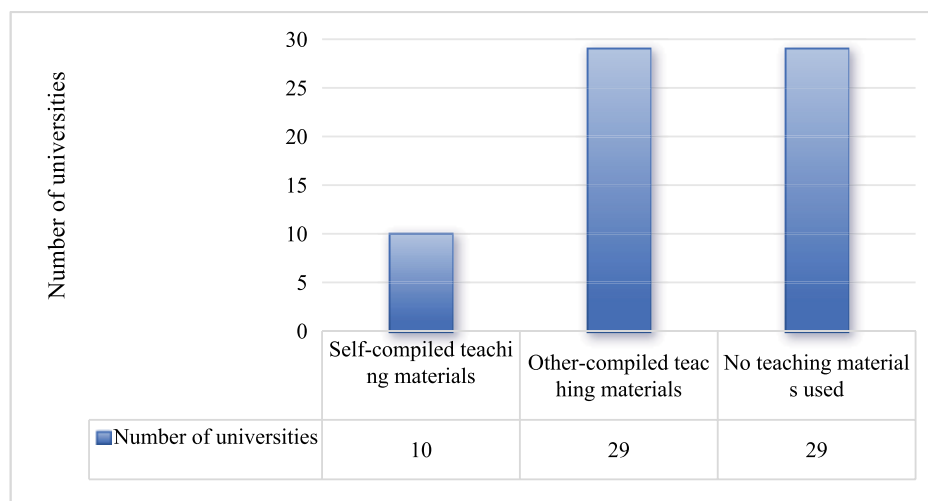
Research indicates that some schools have not yet established fixed labor weeks (months), the content and forms of activities are not rich enough, and there is a phenomenon of labor without education in some universities.

### **3.4. Difficulties in promoting labor education**

The implementation and promotion of labor education also face the following challenges: integrated planning of labor education, construction of labor education resources, integration of labor and professional education, and evaluation of labor education.

An integrated planning of labor education is a prerequisite and a guideline. This includes the integrated development of responsibilities, resources, funding, and teachers. Issues to consider include: How to define the responsibilities and rights of the leading and collaborating departments? How to coordinate the resources and strengths of the entire school? How to select and train labor education teachers? How to ensure necessary funding and other support?

Resource development for labor education is the foundation and vehicle for the construction of labor education courses in universities. According to statistics, the usage of labor education textbooks in 68 universities in Shandong Province is shown in Figure 3. Ten universities have developed their own self-compiled labor education textbooks; 29 universities have not used any textbooks; Shandong University of Business and Technology, Heze University, and Shandong Management University have published labor education textbooks with first-tier publishers such as Higher Education Press; Binzhou Medical University and Shandong University of Political Science and Law are actively exploring characteristic textbooks suitable for different disciplines such as medicine and law, indicating that there are deficiencies in the total number of labor education textbooks, the quality of textbooks, and the availability of characteristic textbooks.



**Figure 3.** Usage of labor education textbooks.

## 4. Implementation plan for labor education in higher education institutions

In terms of labor education talent cultivation, Shandong University emphasizes the comprehensive implementation of the Party's education policy, fulfilling the fundamental task of cultivating morality and fostering talent, incorporating labor education into the talent cultivation plan and the entire process, taking the integration of "five aspects of education" as the starting point, grasping the orientation of labor education, innovating the labor education mechanism, and constructing a comprehensive, theoretical, practical, open, contemporary, and targeted labor education curriculum system. Through the construction of a labor education curriculum group, the development of a "7 + N" list of labor education, and the identification of exemplary labor education posts, the specific implementation plan is as follows:

### 4.1. Constructing a labor education curriculum cluster

Universities should construct a diversified labor education curriculum cluster. These courses should cover both theoretical knowledge and practical skills to meet the needs of students from different majors and with different interests. The construction of the curriculum cluster should be based on the following principles:

- (1) **Comprehensiveness:** The course content should cover multiple aspects of labor education, including labor values, labor skills, and labor laws and regulations.
- (2) **Practicality:** The courses should emphasize practical operation, allowing students to learn and experience labor through hands-on experience.
- (3) **Openness:** The courses should be open to external participation, allowing students from different majors and grades to participate, in order to promote interdisciplinary learning and exchange.
- (4) **Targeted Approach:** The courses should provide personalized learning paths tailored to the characteristics and needs of different students.

### 4.2. Develop a "7 + N" list for labor education and identify exemplary labor education positions

The "7+N list" is a classification method for labor education content. "7" represents the core content of labor education, while "N" represents additional content customized according to school characteristics and student

needs. Core content may include:

- (1) Labor Concept Education: Cultivating students' correct understanding and respect for labor.
- (2) Labor Skills Training: Teaching students basic labor skills and professional ethics.
- (3) Labor Laws and Regulations: Enabling students to understand labor-related laws and regulations.
- (4) Labor Safety Education: Improving students' awareness of labor safety and their self-protection abilities.
- (5) Labor Innovation Practice: Encouraging students to innovate and improve in labor.
- (6) Labor Culture Experience: Experiencing different labor cultures through participation in various labor activities.
- (7) Labor Spirit Cultivation: Cultivating students' labor spirit, such as diligence, perseverance, and cooperation.

The “N” part can be customized according to the school's actual situation and students' needs, such as adding labor practices in specific industries, international labor exchange projects, and labor competitions.

### **4.3. Discover model posts for labor education**

Universities should identify and establish a number of exemplary labor education positions, which can be located within the university or in partner companies outside the university. The objectives of these exemplary positions should consider the following aspects:

- (1) Providing a practical platform: Providing students with real-world work opportunities, allowing them to learn and grow in a realistic work environment;
- (2) Demonstrating the value of labor: Showcasing the value and importance of labor through exemplary positions, enhancing students' understanding of labor;
- (3) Promoting student employment: Exemplary positions can serve as a bridge for students' employment, helping them transition more smoothly into the workplace;
- (4) Strengthening university-enterprise cooperation: Strengthening the connection between the university and industry through cooperation with enterprises, providing students with more learning and development opportunities;
- (5) The selection of exemplary positions should consider factors such as industry representativeness, educational significance, and safety guarantees, ensuring that students can engage in labor practice in a safe and beneficial environment.

Through the above implementation plan, universities can effectively promote labor education, cultivate students' labor awareness and skills, and lay a solid foundation for their future careers and social lives.

## **5. Conclusion**

Labor education plays a vital role in higher education, not only affecting students' all-round development but also being key to improving the quality of higher education. This article analyzes the theoretical foundation, key points of implementation, and difficulties in promoting labor education, and proposes a series of improvement strategies to provide reference and guidance for its implementation in universities. The implementation of labor education requires the joint efforts of universities, teachers, students, and society. Through continuous exploration and practice, a scientific, systematic, and effective labor education system can be formed. In the future, universities should continue to strengthen the construction of labor education courses, innovate teaching methods, and improve evaluation mechanisms to cultivate more high-quality talents with innovative spirit and

practical abilities, making greater contributions to social development.

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# Construction and Analysis of University Teacher Evaluation System Guided by the Principle of Virtue-Education

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**Abstract:** The evaluation system for university teachers is an important component of ensuring the quality of university education. This paper proposes a construction plan for the evaluation mechanism for university teachers based on the guidance of “cultivating virtue and educating people.” This plan takes moral education and academic research as the core evaluation criteria and establishes a comprehensive, scientific, fair, and effective teacher evaluation indicator system, including two major categories of moral education and academic research, covering aspects such as teaching, scientific research, and social services. At the same time, this paper introduces the practical application of this evaluation mechanism and analyzes its evaluation effect. Practice has shown that the evaluation mechanism for university teachers guided by the principle of “cultivating virtue and educating people” has a positive promoting effect on improving the moral education and academic level of teachers and promoting the improvement of the quality of university education.

**Keywords:** Virtue-education; University teacher evaluation; Evaluation mechanism; System construction

**Online publication:** December 31, 2025

## 1. Strengthening the value recognition of teaching and educating people, promoting the transformation of evaluation concepts

The construction of a university teacher evaluation mechanism guided by the principle of teaching and educating people needs to be based on correct concepts<sup>[1]</sup>. The work of teachers is not only about imparting knowledge but more importantly about cultivating students' abilities and qualities, inheriting culture, and contributing to social development. Therefore, the evaluation of university teachers should focus on their overall quality, including teaching level, teaching effectiveness, discipline construction, research capabilities, and social services, rather than just focusing on teachers' teaching achievements and examination scores. At the same time, the evaluation concept should also break free from the constraints of the past “economic man” thinking, which is not only for the management and constraint of teachers' behavior but more importantly for the concern about teachers' development and growth, respecting teachers' professional values and value pursuits<sup>[2,3]</sup>. The university teacher



evaluation mechanism should center on teachers, addressing their personal needs and development, providing tailored services to help them discover their growth paths and unlock their potential, thereby enhancing their professional competencies <sup>[4,5]</sup>.

In addition, the evaluation mechanism for university teachers should also advocate a people-oriented evaluation concept, paying attention to giving play to teachers' subject role and creativity, not only for the development and ranking of the school but more importantly for the growth and development of teachers themselves. The evaluation mechanism should start from cultivating teachers' self-awareness and educational responsibility, encouraging teachers to actively participate in educational teaching reforms and innovations, giving play to teachers' professional strengths and academic influence, and promoting the progress and development of the education cause <sup>[6,7]</sup>. Finally, the construction of a university teacher evaluation mechanism guided by the principle of teaching and educating people also needs to pay attention to teachers' emotional needs, caring about teachers' physical and mental health and job satisfaction, and motivating teachers' professional enthusiasm and creativity. Teachers are the backbone of the education cause, and their growth and development are the key to the development of the education cause. Only by establishing a people-oriented evaluation mechanism, giving full play to teachers' subject role and creativity, can we truly improve the quality and level of university education and teaching and make greater support and contributions to the construction of an education power.

## **2. Scientific evaluation, constructing a university teacher evaluation index system oriented to teaching and educating people**

The construction of a university teacher evaluation mechanism oriented by teaching and educating people is a long and complex task, and its evaluation indicators are an important component of the evaluation mechanism <sup>[8]</sup>. To achieve a scientific and reasonable teacher evaluation, universities need to pay attention to overall planning and systematic thinking and establish an evaluation index system that is suitable for various types of universities and in line with actual conditions <sup>[9,10]</sup>. The design of this index system needs to take teachers' moral education and academic research as the core indicators, while taking into account the evaluation content of scientific research, student work, and social services to promote the coordinated development of various work functions. The evaluation indicators should fully consider the characteristics of teachers of different disciplines, titles, and teaching ages, avoiding the simplification and mechanization of evaluation indicators. At the same time, the formulation of evaluation indicators also needs to draw on advanced teacher evaluation concepts and practical experience at home and abroad and combine them with the actual situation of the school for quantification and classification. Evaluation indicators should not only focus on teachers' performance and achievements but also pay more attention to teachers' educational teaching concepts, teaching methods, and educational psychological qualities to assess teachers' comprehensive abilities and levels. In summary, the construction of a university teacher evaluation mechanism oriented by teaching and educating people needs to establish a scientific and reasonable evaluation index system, which not only aligns with teachers' occupational characteristics but also takes into account the actual situation of the school to promote teachers' growth and improvement and the sustainable development of university education.

## **3. Digitalization support for the university teacher evaluation mechanism, promoting refined management of teaching and educating people**

The construction of a university teacher evaluation mechanism oriented by teaching and educating people is a

long and complex process that requires not only the improvement of technical means but also the emphasis on the core position of educational teaching performance. In this process, the following measures need to be taken:

First, universities should strengthen the top-level design of information construction to ensure the institutional guarantee of technical support for teacher evaluation reforms. The deep integration of information technology and teacher evaluation mechanisms is the key to achieving the modernization of teacher evaluations. In addition, we need to make full use of information technology to establish a database of university teacher information to comprehensively record the dynamic data of teachers' work and professional growth and to strengthen the process evaluation of university teachers. This database should be regularly updated and provide convenient and accurate functions for reading teachers' evaluation information so that teachers and educational management departments can better grasp and evaluate teachers' job performance. We should also make full use of information technology to build a data analysis platform for university teacher evaluations, achieve quantitative and qualitative assessments of each teacher through automatic data analysis, realize the intelligence and precision of university teacher evaluations, and promote the routine implementation of university teacher evaluations.

At the same time, attention should be paid to protecting teachers' privacy and information security to ensure the fairness, openness, and transparency of the evaluation process. On this basis, we also need to emphasize the core position of educational teaching performance, improve the evaluation index system of educational teaching performance, including multiple indicators such as scientific research, student work, and social services. In addition, we should strengthen the evaluation of the educational teaching process, emphasize the core position of educational teaching evaluation indicators, and increase the weight of evaluation results in aspects such as job hiring, title evaluation, talent selection, and performance assessment. Finally, we should innovate the incremental evaluation of educational teaching performance, encourage teachers to participate in educational teaching reforms and innovative practices, and promote the scientificity, fairness, and effectiveness of university teacher evaluations.

#### **4. Establishing a teacher evaluation result feedback mechanism, strengthening moral education**

The application and feedback of teacher evaluation results are important links in the construction of university teacher evaluation mechanisms. By applying the evaluation results of teachers, we can promote teaching improvements and the enhancement of moral education and better serve students and society. At the same time, timely feedback mechanisms can also effectively improve teachers' understanding of teaching work and mastery of educational teaching. First, universities can provide personalized teaching improvement suggestions to teachers based on evaluation results. By analyzing evaluation results, we can understand teachers' strengths and weaknesses in teaching, as well as the shortcomings and problems existing in teaching, and thus propose corresponding teaching improvement suggestions. For example, guidance and assistance can be provided in aspects such as teaching strategies, curriculum design, and textbook selection to help teachers improve their teaching methods and enhance teaching effectiveness. Second, the feedback of teacher evaluation results can also promote teachers' personal growth and development. Teachers can understand their own teaching achievements and shortcomings through evaluation results, set clear goals and directions for their professional development. In addition, teachers can also learn from and exchange ideas with other outstanding teachers to further improve their teaching levels and abilities and achieve personal growth and professional development. Finally, the

application and feedback of teacher evaluation results can also promote the overall quality improvement of university teachers and the construction of moral education. By applying and feeding back evaluation results, we can continuously improve teachers' teaching quality and teaching abilities, thereby promoting the overall improvement of the university's educational teaching level. At the same time, the feedback of evaluation results can also promptly discover and correct teachers' improper behaviors, improve teachers' moral education levels, and ensure the quality and fairness of educational teaching. In summary, the establishment of a scientific university teacher evaluation mechanism not only requires strengthening university information construction and comprehensively building a teacher information database but also requires giving full play to the application and feedback roles of evaluation results to provide effective guarantees and support for teachers' teaching improvements, professional growth, and the overall improvement of university educational teaching quality.

The application and feedback of teacher evaluation results are crucial links in the construction of university teacher evaluation mechanisms. By applying the evaluation results of teachers, we can promote teaching improvements and the enhancement of moral education, better serving students and society. To gauge the effectiveness of the proposed evaluation mechanism, a survey was conducted among 32 students in a selected class. The survey aimed to assess students' perceptions of their teachers' performance in virtue-cultivation and academic guidance.

As shown in **Table 1**, the majority of students reported positive experiences, with high agreement on teachers' ethical behavior and encouragement of creativity. These findings support the notion that a comprehensive evaluation mechanism, incorporating both moral education and academic performance, is effective in fostering a conducive learning environment.

**Table 1.** Student perceptions of teacher performance in virtue-cultivation and academic guidance

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Teachers effectively incorporate moral education into their lessons.	20	10	2	0	0
2. Teachers are actively engaged in research and share findings with us.	15	12	5	0	0
3. Teachers provide adequate guidance for social service projects.	18	8	4	2	0
4. Teachers encourage creativity and innovation in the classroom.	22	8	2	0	0
5. Teachers are role models for ethical behavior.	25	7	0	0	0

## 5. Conclusion

With the intensifying competition in higher education, improving education quality has become an important task for universities. Building a university teacher evaluation mechanism guided by the principle of cultivating virtue and educating people is an important means to promote the improvement of education quality. The construction and implementation of the university teacher evaluation mechanism requires the attention and support of the whole society, and only through the joint efforts of all parties can good results be achieved. University administrative departments need to strengthen information construction, improve the database of teacher information and the data analysis platform for evaluations, and provide more scientific and precise data support for teacher evaluations. Teachers should also actively participate in the construction of the evaluation mechanism, conduct in-depth reflection and summary on their own teaching work, continuously improve their own teaching levels, and make greater contributions to the improvement of university education quality.

In addition to the technical and conceptual discussions, the inclusion of student feedback through the survey highlights the practical implications of the proposed evaluation mechanism. The positive responses from students underscore the importance of integrating moral education and academic performance in teacher evaluations. This approach not only enhances teaching quality but also aligns with the broader goals of nurturing well-rounded talents. As universities strive to improve education quality, incorporating student feedback into the evaluation process can provide valuable insights for continuous improvement.

## Disclosure statement

The authors declare no conflict of interest.

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# Xu Yangben's Family Education Thought and Its Contemporary Enlightenment

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**Abstract:** Xu Yangben, born in Wuxi, Jiangsu Province in 1914 (year of death unknown), graduated from the School of Education, Daxia University in 1940. He has served as a middle school principal, primary and secondary school teacher, university professor, etc., and has worked in institutions such as the National Chongqing Normal School, Zhijiang University, Daxia University, and Guangxia Commercial College. He also founded Zhiren Middle School in a place in Shanghai and served as its principal, enjoying a certain reputation in educational circles in Guiyang and Shanghai. This paper mainly discusses that Xu Yangben's educational thought has gone through three stages from germination to maturity: the "Blind Period," the "Transition Period," and the "Enlightenment Period." It focuses on Xu Yangben's family education thought: first, parents should have an accurate position in the family; second, attach importance to children's practical guidance and labor training; third, identification of "problem children" and educational discipline; fourth, pay attention to the combination of educational environment transformation and child-centeredness. His thought bears the shadows of Tao Xingzhi, Chen Heqin and Yan Yangchu, but he also has a relatively complete ideological system in educational practice. In particular, his family education thought has certain enlightenment significance for contemporary family education.

**Keywords:** Xu Yangben; Family education thought; Enlightenment

**Online publication:** December 31, 2025

## 1. Introduction

Xu Yangben, born in Wuxi, Jiangsu Province in 1914 (year of death unknown), graduated from the School of Education, Daxia University in 1940. He has served as a middle school principal, primary and secondary school teacher, university professor, etc., and has worked in institutions such as the National Chongqing Normal School <sup>[1]</sup> (a famous secondary normal school during the war), Zhijiang University <sup>[2]</sup> (one of the thirteen Christian universities in China), Daxia University <sup>[3]</sup> (a comprehensive private university in Shanghai), Guangxia Commercial College <sup>[3]</sup>, and Jiangsu Normal College <sup>[4]</sup> (now Jiangsu Normal University). During his university years, he led students to run schools on the ground through classroom teaching, and founded Zhiren Middle



School on the east bank of the Huangpu River and served as its principal <sup>[5]</sup>. During his tenure in primary and secondary schools, he was quite famous in educational circles in Guiyang, Shanghai and other places <sup>[6]</sup>. In the early 1980s, he co-published the article “A Comprehensive and Correct Evaluation of Tao Xingzhi’s Educational Thought” with Mr. Wang Siqing in the famous educational journal “Educational Research,” which caused a strong response at that time and set off a famous academic debate in the history of Tao Xingzhi research. Although Xu Yangben was not as famous as contemporary educators such as Wang Yukai, Chen Bochui and Yu Huandou, who worked with him, he had rich educational experience and derived many high-quality educational theories from practical educational practice, with many unique views on education that are worthy of learning today.

## **2. The formation process and historical evolution of Xu Yangben’s educational thought**

Xu Yangben’s educational thought has gone through three stages from germination to maturity, which he divided into three periods: the “Blind Period”, the “Transition Period” and the “Enlightenment Period.”

### **2.1. The “Blind period” of Xu Yangben’s educational thought**

Originally, Xu Yangben’s year of birth and death were unknown, but at the end of his autobiographical educational novel “Teacher Xu”, there is a writing time of “May Day of the 37th year of the Republic of China at No. 40 North Humaoming Road” <sup>[5]</sup>. The article also mentions that “seventeen years ago, Teacher Xu was only seventeen years old” <sup>[5]</sup>. The 37th year of the Republic of China was 1948; seventeen years ago, he was seventeen years old, that is, he was seventeen years old in 1931. Therefore, it can be roughly inferred that he was born in the 3rd year of the Republic of China, namely 1914. In addition, according to the alumni records of Zhijiang University in Zhejiang Provincial Archives, Xu Yangben’s ancestral home was Wuxi, Jiangsu Province <sup>[10]</sup>.

From the article “Teacher Xu,” we can get Xu Yangben’s general life experience: his family was broken in his early years, and both parents passed away. He dropped out of junior high school at the age of seventeen. In the following two or three years, influenced by his father, he did not want to enter educational institutions, but had to work as a substitute teacher in a school due to the pressure of life. Later, he obtained a high school diploma and was transferred from a substitute teacher to a formal staff member. Before entering Daxia University, he basically wandered around the Jiangsu and Shanghai areas. Except for the two or three years after dropping out of junior high school, when he did not enter the education industry, he then started his turbulent life. Xu Yangben divided his educational experience into three periods, and he called the first stage the “Blind Period”. According to the above inference, he dropped out of junior high school in the 20th year of the Republic of China (1931). After working in factories for two or three years, he wandered to a small town outside Wuxi and started his educational career (around 1933–1934). This period was basically an introductory exploration stage of education. He believed that his state at that time was “having the temper of treating students as slaves, passing on the pain of being oppressed in the past and traditional conservative education to the next generation of students” <sup>[5]</sup>. Due to beating and scolding students, being humiliated by students, being lovelorn and other reasons, he wandered constantly for two or three years.

### **2.2. The “Transition period” of Xu Yangben’s educational thought**

Xu Yangben called the second period the “Transition Period.” During this period, he deeply realized that he

wanted to change China's backward and ignorant state, so he chose to study diligently and save the country through education. At the same time, in order to change his own traditional, backward, and ignorant state, as stated in "Teacher Xu": "When the August 13th gunfire rang out, the school moved westward, and Teacher Xu followed the school. At first, he was worried about the three years of courses he had not finished" <sup>[5]</sup>. "August 13th" refers to the "August 13th Incident," also known as the "Battle of Shanghai," which broke out in 1937. Moreover, "Teacher Xu" also says: "He also thought that in the future, after finishing these four years of university and obtaining a university diploma, he would be able to live such a wealthy life" <sup>[5]</sup>. It can be seen that Daxia University has a four-year academic system. Therefore, it can be inferred that Mr. Xu Yangben should have been admitted to the Department of Education, Shanghai Daxia University in 1936 and spent one year in university. After the outbreak of the August 13th Incident in 1937, Daxia University had to move to the rear area. In January 1938, it united with Fudan University in Changsha to establish the first joint university in Chinese history, "Fudan-Daxia United University." The First Fudan-Daxia United University moved to Jiangxi and disbanded in February 1938. The Second Fudan-Daxia United University moved to Guiyang Huaxi Campus for school, and Xu Yangben also followed the school to Guiyang and graduated in 1940. In the same year, Fudan University and Daxia University became completely independent, and the Second United University was officially abolished.

After graduation, he took up the post of political instructor at a military academy in Hunan, before resigning from the position later. Later, he returned to a provincial middle school in Guiyang to teach history and geography. During this period, he gradually had some new views on education. Later, he resigned and wandered to work as the director of academic affairs in a primary school attached to a transportation agency in Guiyang. At that time, there were three employees' children's primary schools in Guiyang: Southwest Highway Bureau Employees' Children's Primary School, founded in 1941, Guiyang Employees' Children's Primary School of the 10th Transportation Office with unknown founding time, and Guiyang Railway Employees' Children's Primary School, founded in 1947 <sup>[10]</sup>. According to Xu Yangben's life story and the material in the article "How to Guide Students to Write Weekly Journals" which mentions "Guiyang Employee's Children's Primary School," this article was published in "Southwest Highway" in 1942, so the first two are possible. Because he had the experience of being a primary school teacher before, Xu Yangben was soon praised in Guiyang's educational circles and began to "pay attention to the holistic nurturing of living education" <sup>[5]</sup>. However, due to unfair treatment, he later wandered to Chongqing. When leaving the employee's children's primary school, the children's tearful farewell made him start to think about the true essence and significance of education. Since then, he was determined to reform society, arouse "human nature," and serve in the educational circle forever. This period was called the "Transition Period" by Mr. Xu Yangben himself.

### **2.3. The "Enlightenment period" of Xu Yangben's educational thought**

The third period of Xu Yangben's educational career was called the "Enlightenment Period" by himself. After arriving in Chongqing, Xu Yangben "first worked as the director of academic affairs in an accounting class in the suburbs that recruited students from war zones" <sup>[5]</sup>. After resigning, he entered a middle school, and in the second semester, he wandered to the National Chongqing Normal School to work as a teacher and concurrently worked in the academic affairs office. It is worth mentioning that the National Chongqing Normal School was one of the representatives of secondary normal schools during the war and a landmark school for the development of secondary normal education during the War of Resistance against Japanese Aggression. Mr. Cui Yunwu commented: "If it is said that the overall development of secondary normal education during the eight

years of the War of Resistance against Japanese Aggression was based on the previous foundation, then one of the symbols of this development is the emergence of some normal schools with certain school-running quality and characteristics. Among these normal schools, the National Chongqing Normal School is one of the representatives”<sup>[1]</sup>. Xu Yangben once served as an associate professor in this secondary normal school. Later, due to lovelorn, Xu Yangben resigned from the National Chongqing Normal School and transferred to Zhijiang University in August 1944 to serve as a full-time lecturer in the Department of Education, College of Liberal Arts<sup>[9]</sup>, and concurrently worked in the academic affairs office<sup>[5]</sup>. When Xu Yangben taught at Zhijiang University, it was “the two years before and after the victory of the War of Resistance against Japanese Aggression”<sup>[9]</sup>, which should be around 1944. Later, the War of Resistance against Japanese Aggression was won. “In the first month of the 34th year of the Republic of China, he personally led the students of that university to move back to Shanghai”<sup>[5]</sup>. “That university” refers to Zhijiang University. After the victory of the War of Resistance against Japanese Aggression, due to the serious damage to Zhijiang University’s campus, books, equipment, etc., in Hangzhou, senior students resumed classes in Shanghai after moving eastward. The 4th issue of the 24th volume of “Daxia Weekly” also mentions that Xu Yangben taught at Zhijiang University in the 35th year of the Republic of China<sup>[6]</sup>.

At this stage, Xu Yangben first proposed that education should be socialized. Socialization means that ordinary people also have the right to receive education, which is similar to Yan Yangchu’s “mass education view.” He advocated that all people have equal opportunities to receive education and advocated the popularization of national education. Secondly, he advocated the simplicity of school buildings and that the campus environment should not be artificially beautified. Thirdly, he advocated that junior high schools should be generally established as regular schools. Junior high school should be an extension of compulsory education, encouraging all primary school graduates to have the opportunity to enter junior high school to improve people’s cognitive level. Fourthly, he advocated the implementation of a dual-track system in senior high school. Based on the dual-track system, he advocated the establishment of more vocational high schools and five-year vocational colleges to cultivate a group of useful professional cadres to meet the urgent needs of society. Finally, he advocated the use of living teaching materials. He proposed six types: “knowledge, physical fitness, emotion, group, and skills,” believing that these six types of education are equally important and there is no distinction between main and auxiliary subjects. He noticed that we should not only focus on “self-education” but also consider the social environment. Mr. Xu Yangben believed that without the joint cooperation of society (including family) and schools, education cannot be completed. He believed that society has too many “suggestive” effects, leading to unsatisfactory school education, and even weakening and invalidating. Therefore, Xu Yangben advocated “social education,” which he called “holistic education.” Before educating students, it is necessary to reform parents and the social environment; it is necessary to take the combination of “transforming the social environment” and “adapting to children’s oriented life” as the premise.

During this period, against the backdrop of the times, Xu Yangben also held that the development of education at that time was in need of transformation. It should not be excessively attached to external orientations, so as to avoid the situation where teachers’ teaching autonomy was constrained, the original intention of curriculum design was deviated from, and students’ growth paths were improperly guided. The value of education has never been to serve the demands of a minority group, but to benefit the common interests of the general public. Since the fundamental goal is public welfare, it is imperative to restore the purity of education in schools, enabling education to exert its inherent leading role, promote the development and improvement of individuals, and thereby indirectly drive the society towards positive progress<sup>[5]</sup>.

Therefore, he focused on the research of “social education” and offered a course on “social education” in universities. This period was called the “Enlightenment Period” by Mr. Xu Yangben. Later, he gave lectures at the Shanghai Primary School Teachers’ Seminar and “won great praise from the audience”<sup>[6]</sup>. In 1948, he entered Daxia University to teach the course “Child Psychology.” After the founding of New China, there is almost no record of Xu Yangben’s life, and he occasionally published articles. It was not until the early 1980s that he co-published the article “A Comprehensive and Correct Evaluation of Tao Xingzhi’s Educational Thought” with Mr. Wang Siqing in the famous educational journal *Educational Research*. It aroused a strong response at that time and set off a major wave of academic debate in the research history of Tao Xingzhi<sup>[8]</sup>.

### **3. Xu Yangben’s family education thought and its contemporary enlightenment**

#### **3.1. Parents should have an accurate position in the family**

The positioning of parents in family education is a process of historical evolution. In traditional society, parents possessed absolute rights and authority, and children were obliged to obey their wishes and demands. However, with social progress and the transformation of people’s ideological concepts, the positioning of parents in family education has gradually undergone changes. Modern society emphasizes equality and mutual respect among family members; parents no longer hold absolute power but engage in equal dialogue and consultation with their children.

Whether parents’ positioning in family education is accurate exerts a significant impact on the growth and development of children. On the one hand, parents are children’s first teachers, and their words and deeds exert a profound influence on children. By accurately grasping their own positioning in family education, parents can better guide their children’s growth and help them establish sound values and outlooks on life. On the other hand, the establishment of a positive parent-child relationship between parents and children helps build a bridge for parent-child communication and facilitates mutual understanding and respect between both parties. This enables children to be willing to communicate with their parents and seek help and support when encountering problems during their growth.

In view of the irreplaceable role of parents in children’s growth, Xu Yangben repeatedly mentioned that transforming parents is an important task. “He believed that to transform children, we must first transform their parents”<sup>[5]</sup>. Therefore, in family education, parents should have an accurate position, change some traditional concepts, and change their family position. In education, the role of parents play an extremely important role in children’s development. Therefore, in many cases, adults’ behaviors and words will be regarded as objects for children to imitate. Therefore, parents should be cautious about the implications of their own words and deeds for their children in family education. Adults’ hints are generally divided into intentional hints and unintentional hints. Intentional hints refer to adults’ acquiescent behaviors and guidance. For example, the development of children’s stealing habits is often because parents do not punish or correct them on the grounds that their children are too young. Over time, children think that such things are not only harmless but also can be protected by their parents, and bad habits are formed. Unintentional hints refer to certain unintentional behaviors of adults that are imitated or misunderstood by children. For example, when adults smoke, children will imitate them, which is an unintentional hint. For this reason, Xu Yangben emphasized that parents should re-examine their own position in the family. Parents should not only care about their children’s material needs but also pay attention to their spiritual needs, mental health, and moral development. Through their own exemplary power, parents can establish correct values and behavioral norms, set an example by words and deeds, and set a good “model” for



their children. As he said when discussing the impact of the family environment on children's language: "If there is a good language environment, and parents, brothers and sisters can all speak correct Mandarin, the child will surely be able to speak good Mandarin in the future; if parents and elder siblings all speak dialects, the child will surely speak dialects in the future. If not paid attention to when young, it will not be easy to learn when growing up"<sup>[11]</sup>.

Therefore, Xu Yangben believed that the accurate positioning of parents in the family is crucial, and parents have multiple roles and responsibilities. They are not only the nurturers, educators, role models, and supporters of their children, who need to meet their children's basic living needs, but also provide a sense of security and educational guidance for their children, and cultivate their children's independence and self-confidence through communication and understanding. Instead of regarding children as their own property and completely imposing their own behaviors and ideas on them. Parents should respect their children's individuality and choices, respect the laws of their physical and mental development, maintain patience and tolerance, and give more encouragement and affirmation. At the same time, a harmonious marital relationship, reasonable family rules and attention to family time are all key to ensuring family harmony and children's healthy growth.

### **3.2. Attach importance to children's practical guidance and labor training**

Practical guidance and labor training have a profound historical background and practical significance in children's growth. From a historical perspective, from the ancient apprentice system to modern school education, practice and labor have occupied a certain position in the field of education. This traditional educational method not only imparts theoretical knowledge but also emphasizes the cultivation of practical application and labor skills. For example, ancient craftsmen or farmers inherited skills and promoted social progress through personal practice and labor. Practical guidance and labor training are of great significance to children's growth and development in many aspects. On the one hand, practice is an important way to acquire knowledge. Through personal participation and experience, children can better understand abstract concepts and theoretical knowledge and transform them into practical operational skills. On the other hand, labor training not only cultivates children's practical ability and labor awareness but also shapes their qualities of diligence, perseverance, and self-reliance, which helps to form a healthy personality. Finally, practice and labor are also important means of children's socialization. Through cooperation and communication with others, children can cultivate good interpersonal relationships and teamwork spirit.

The important points of Xu Yangben's family education thought can be roughly summarized as guidance, training, and practice (games). Xu Yangben pointed out: "We should adopt a compromise method. When children are young, because it is a period when they are supposed to develop habits, we can lean slightly towards interventionism to ensure that they are on the right track from an early age; when they are older and can live independently, we can gradually transition to liberalism. However, this is not absolute. We need to teach students in accordance with their aptitude based on their environment and facts"<sup>[11]</sup>. Therefore, parents must adopt relevant methods according to their children's physical and psychological characteristics. If children's physical and mental development is intervened too early, it will not only damage their mental health but also often lead to children's greater resistance to the issues or events guided by their parents. In guiding children's or students' practice, on the one hand, Xu Yangben believed that parents play the role of guides. For example, parents should guide children who cannot carry out independently or have misunderstandings. On the other hand, Xu Yangben also believed that attention should be paid to children's basic skill training, such as language training, basic etiquette and emotional development. Finally, he also believed that the knowledge and skills learned by children



should focus on practice, and training and expanding thinking in practice. For example, the practice of etiquette: parents guide their children to give up their seats to the elderly, weak, sick, disabled, pregnant and lactating on public transportation.

### **3.3. Identification of “Problem children” and educational discipline**

Problem children generally refer to teenagers and children who have problems in behavior, emotion, academic performance, conduct, etc. Identifying and disciplining problem children is an ancient and practical issue. Historically, different cultures have adopted various methods to identify and correct problem children, such as the ancient Chinese concept of “If a child is not educated, it is the father’s fault”, the educational method of “Spare the rod and spoil the child,” and flogging and corporal punishment in the Western Middle Ages. In modern society, people’s educational methods and disciplinary measures for problem children are more diversified, but there are also controversies. However, identifying problem children is of great significance for early intervention and prevention of problem behaviors. By identifying problem children, parents, teachers and society can provide targeted support and help to prevent the further deterioration of problem behaviors. At the same time, early intervention for problem children helps to promote their healthy growth and development. Educational discipline is one of the important means to correct problem children’s behaviors. Reasonable educational discipline can educate children to understand behavioral norms and values, restrain bad behaviors, and promote their development of good social behaviors.

However, the use of educational discipline must be appropriate. Excessive or improper use may cause physical and psychological harm. In modern society, the educational methods and disciplinary measures for problem children show a diversified development trend. In addition to traditional educational methods such as persuasion, warning and reproach, many new methods have emerged, such as family therapy, psychological counseling and positive reinforcement. These methods help to understand and solve children’s problem behaviors from multiple aspects. Through early identification and reasonable educational discipline, problem children’s behaviors can be corrected, and their healthy growth and development can be promoted. When using educational discipline, we must consider the child’s age, personality, the nature and severity of the problem behavior, as well as the expectations of the family and society to ensure the rationality and effectiveness of educational discipline. At the same time, attention should be paid to children’s long-term development and diversified educational methods to provide comprehensive support and help for problem children.

Xu Yangben re-interpreted “problem children” to facilitate educators to identify truly “unruly children” in daily life. In his book “The Theory and Practice of Family Education,” Xu Yangben mentioned that many parents and teachers regard some lively and naughty children who are unwilling to act according to the wishes of teachers or parents as “unruly.” “What they call unruly is nothing more than being active, violent and disobedient. On the contrary, they are regarded as excellent children”<sup>[11]</sup>. Therefore, this often leads to the result that “due to this arbitrary vision, teachable children are often regarded as unteachable, and even negative means are often used to deal with them, making these children wronged. It really has to be said that it is a pity”<sup>[11]</sup>. Therefore, in many cases, the unruly children considered by school teachers or parents are not necessarily truly unruly. Xu Yangben believed that in identifying unruly children, psychology should be used to truly identify them. Truly problem children should be divided into “unruly” and “inferior.” “Unruly” refers to having some abnormal psychology, such as psychological disorders, psychological defects, etc. While “inferior” focuses more on physiological functions, such as dementia, foolishness, etc. in terms of IQ. Therefore, our perspective on some lively and active children should be changed.

### **3.4. Pay attention to the combination of educational environment transformation and child-centeredness**

Paying attention to the combination of educational environment transformation and child-centeredness emphasizes fully focusing on children's needs and individuality in the educational process and creating an educational environment conducive to children's growth and development, that is, paying attention to the edification of the real environment. Education in China has always had a tradition of emphasizing the choice of educational environment. For example, Zhuangzi said in "Butcher Ding Dismembers an Ox": "Therefore, a gentleman stays away from the kitchen". A gentleman needs to stay away from killing things, which also notices that people's "sense of compassion" will be influenced by the "environment." It is also because the influence of the environment on people is imperceptible. Therefore, in the transformation of the modern social environment, the promotion of some slogans advocating virtues, public service advertisements and public morality all have a good effect on improving the social atmosphere. Family education needs a good environment, including a good environment of schools, families and society. To build such an environment, society, families and schools have great responsibilities. As Xu Yangben said: On the lecture platform, educators spare no effort to impart to children the life principles of pursuing goodness. However, when they step out of the school gate or engage in daily life beyond the campus, they will inevitably encounter quite a few inappropriate behaviors and ways of doing things. Given that children's mental faculties are not yet fully developed and their ability to distinguish right from wrong is still in the formative stage, and that imitation is an innate human instinct, the silent implications of the surrounding environment will often subtly reshape their cognitive patterns and behavioral modes <sup>[5]</sup>. Therefore, the enlightenment of school education, the good guidance of social atmosphere and the accurate positioning of family education can create a society with a generally good atmosphere.

Xu Yangben believed that paying attention to the combination of educational environment transformation and child-centeredness can, on the one hand, fully focus on children's needs and individuality, mobilize their learning enthusiasm and initiative, and improve learning effects. The display and layout of the environment can imperceptibly affect the direction of children's development. When the educational environment matches children's needs and individuality, they will be more willing to participate in learning activities, give play to their potential, and thus achieve better learning effects; at the same time, a warm and healthy environment plays a great role in shaping children's personality. On the other hand, paying attention to the combination of educational environment transformation and child-centeredness helps to cultivate children's sense of autonomy and innovation ability. In a relaxed, free and inspiring educational environment, children can better give play to their imagination and creativity and cultivate their ability of independent thinking and problem-solving. Finally, paying attention to the combination of educational environment transformation and child-centeredness helps to promote equality and interaction between parents and children. Under this educational concept, parents and children are partners in equal dialogue and communication. This interactive relationship is conducive to enhancing trust and communication between parents and children and promoting children's all-round development.

All the above fully shows that environmental transformation plays an extremely important role in education. Therefore, to give play to the imperceptible role of the environment, it is necessary to pay attention to the transformation of the environment not only in families and schools but also in society. As Xu Yangben said: "For any child with bad habits, if the environment change method is adopted to integrate their feelings, it can indeed change their habits in fact" <sup>[11]</sup>. Therefore, schools and families should attach importance to environmental transformation and construction, atmosphere creation and cultural edification. For example, the construction of campus culture in schools: schools can make full use of cultural walls, red education bases, campus newspapers,

campus cultural festivals, etc.; and the creation of family atmosphere: families can make efforts in the construction of study rooms, lighting, wall colors, children's room layout, etc.

Finally, the relationship between schools, families and society in the transformation and construction of the educational environment should be inseparable. For example, in family education, many social figures still have a vague understanding of family education, and even think that after sending students to school, students' education has little to do with the family. This view is obviously wrong. In response to this problem, Xu Yangben proposed that home-school cooperation should be adopted to teach students. Like Mr. Tao Xingzhi, he advocated the "Little Teacher System". "In short, families should contact schools, and schools should also be responsible for families. Schools must often hold parent-teacher meetings, conduct home visits, or implement the Little Teacher System, which are effective methods for mutual contact between schools and families"<sup>[11]</sup>. In addition, Xu Yangben also believed that to ensure the good promotion and implementation of family education, it is best for the state to introduce relevant policies to support the development of family education, so that family education has a foundation for development and soil for promotion. He believed that "the highest educational authorities should order local educational administrative organs at all levels to set up more children's welfare institutions, such as children's amusement parks, nurseries, children's homes, kindergartens, health centers, mothers' associations, children's nutrition research associations, children's health competitions, family education instructors, rural model families, primary school teachers' seminars, etc.; to transform families, benefit children, and cultivate the masters of the next generation of the country"<sup>[11]</sup>.

#### 4. Conclusion

In summary, Xu Yangben's educational ideology, rooted long-term in frontline educational practice and in-depth theoretical reflection, has developed into a relatively complete system characterized by rigorous logic, rich connotations, historical adaptability and practical guidance. His ideological evolution went through three phases: blind exploration – transformative reflection – insightful maturity. From his early stage of intellectual unclarity about the essence of education, to his middle stage of inquiry into the true nature of education, and finally to his later stage of formulating systematic propositions covering educational socialization, school system reform, the application of living teaching materials, and the six-dimensional educational objectives of knowledge, physical fitness, emotion, sociality and skills, his ideology has always taken the cultivation of human beings as its core tenet, highlighting the dominant position of children in education.

He also made remarkable achievements in the field of family education. Based on his book *The Theory and Practice of Family Education* and articles such as *Yaping's Success*, a relatively complete ideological system of family education can be sorted out. First, he clarified the positioning of parents, emphasizing the diversity and exemplariness of parental roles, thus laying the foundation for the rights and responsibilities of family education. Second, integrating knowledge guidance with labor practice and based on the laws of children's physical and mental development, Xu constructed a cultivation path featuring guidance – training – practice. Third, he proposed scientific methods for identifying children with behavioral issues and rational disciplinary approaches, establishing a psychology-informed model of rational education. Finally, he combined the improvement of educational environments with child-centeredness, building a collaborative educational ecosystem involving families, schools and society, and forming an all-round education framework. These four aspects are interrelated and mutually reinforcing, together constituting the complete theoretical framework of Xu Yangben's family education ideology.

Xu Yangben's educational ideology not only absorbed the ideological essence of contemporary educators such as Tao Xingzhi, Chen Heqin and Yan Yangchu, but also incorporated his practical insights gained from working in multiple schools and running educational institutions across different regions. Free from the limitations of a single theoretical perspective, it achieved a profound integration of theoretical depth and practical relevance. Although some of his viewpoints sparked controversies in specific historical periods, the profound insights into the essence of education, respect for the laws of children's development, advocacy of family-school-society collaborative education, and vigilance against the utilitarian tendency of education embodied in his ideological system still hold significant theoretical value and practical reference significance today. His educational pursuit, centered on child-first principle and oriented towards social progress, provides valuable ideological resources and practical enlightenment for contemporary education reform, the optimization of family education and the improvement of collaborative education mechanisms, demonstrating the timeless vitality of classic educational ideology.

## Disclosure statement

The authors declare no conflict of interest.

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# Research on the Effect of the Application of E-learning Portfolio on MOOC Self-learning

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**Abstract:** With the rapid development of AIGC education, brand new methods of learning, such as MOOC and E-Learning Portfolio, have emerged, which revolutionize the traditional way of learning. Instead of teacher-centered theory, the learners' autonomy is given more attention. Therefore, self-learning ability becomes an indispensable part of students' comprehensive quality. Under the circumstances, our group conducted a 16-week experiment based on these two learning methods, aiming to find out their effect on students' self-learning ability. Our experiment led to the conclusion: the application of MOOC-learning portfolio has a positive influence on the development of students' self-learning abilities.

**Keywords:** E-learning portfolio; MOOC; Self-learning

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## 1. Research background

The informatization of education has become a trend. Against the backdrop of AIGC Education, education is becoming increasingly informatized. In contemporary society, the traditional teaching model can no longer meet students' diverse needs for knowledge, and AIGC learning has become an important channel for students to acquire new knowledge <sup>[1]</sup>. Innovations in online education regarding teaching scenarios, technologies, and formats have made knowledge acquisition more ubiquitous, gradually changing people's learning habits <sup>[2]</sup>.

The ability for self-learning has become a fundamental quality for individuals. self-learning is a modern learning method contrasted with traditional receptive learning <sup>[3]</sup>. Traditional learning methods emphasize the passive acceptance and cramming of learning content, which can easily lead to student dependency, failing to cultivate independent thinking and inquiry skills, which is detrimental to lifelong learning. Furthermore, the ability for self-learning is even more crucial in an era of ubiquitous learning <sup>[4]</sup>. Faced with abundant learning resources, students who know how to learn and are adept at learning will undoubtedly have a significant advantage.

English teaching and assessment methods are facing reform. In terms of English classroom teaching methods, "engaging students" will gradually replace mechanical teacher explanation and drills in the classroom,



focusing on the contextual nature of learning, the applicability of content, and individual student differences. In terms of English course assessment, “performance competency evaluation” will also replace the “score-only” approach.

Based on an understanding of the above background, the project team proposed a learning model combining the online learning tool MOOC (Massive Open Online Course) with the E-Learning Portfolio <sup>[5]</sup>. Volunteers participated in a 16-week experience of this model, and were assessed after 16 weeks to attempt an analysis of the impact of this learning model on students’ self-learning ability. The so-called MOOC is a model for developing online courses. Volunteers spent 16 weeks taking online courses related to TEM-4 (Test for English Majors-Band 4) English skills and themes via MOOCs. The E-Learning Portfolio is an online tool that can record students’ growth process. Volunteers established their own e-portfolios, recording their learning processes, learning outcomes, personal reflections, etc. <sup>[6]</sup> The assessment of self-learning ability was also conducted through phased, modular tests with different weightings.

## **2. Research status: Home and abroad**

### **2.1. Domestic research status**

Team members primarily reviewed research summaries related to e-portfolios and MOOCs to explore the current state of research on both.

#### **2.1.1. Research status of e-portfolios**

According to Duan Ninggui’s “Analysis of the Status Quo of Domestic Electronic Portfolio Research and Application in Recent Years” (2008), regarding e-portfolios as an educational technology, domestic research predominantly focuses on their evaluative functions; domestic theoretical research on e-portfolios is relatively sufficient, but there is a lack of specific application and development; the vague definition of e-portfolios is a reason affecting the further development of related research. Regarding their specific application, Huang Yajing, in her “Review of Research and Application of Electronic Portfolios in English Education in China” (2014), pointed out that East China Normal University and Capital Normal University were the first domestic institutions to adopt the e-portfolio learning approach, applying it to teacher training. Subsequently, other universities used it for English teaching (e.g., speaking, listening, writing, and situational communication) <sup>[7]</sup>. It confirmed that this learning model helps improve students’ language skills and knowledge, as well as their self-learning ability. Furthermore, regarding the research status of MOOCs, team members learned from Zhao Leilei, Zhao Keyun, and Xu Jin’s “A Review of MOOC Research in China Based on Quantitative Analysis” (2014) that the MOOC learning model, course design, and Small Private Online Courses (SPOCs) have been the focus of domestic research in recent years. Guan Siyi’s “A Review of University Teaching Research Based on MOOCs” (2020) described the upsurge in domestic university MOOC research and development, noting that education departments have also shown great attention to MOOC construction, with coexisting opportunities and challenges.

#### **2.1.2. Research status of MOOCs**

Using the CNKI Chinese Journal Full-text Database as the data source, team members conducted a paper search with the keywords “MOOC” and “English”, retrieving only three relevant papers <sup>[8]</sup>. Among them, Zhang Dian’en and Wang Yunzhe’s “Research on the Construction Ideas and System Structure of ‘College English MOOCs’”

mainly elaborated on constructing a college English MOOC system structure comprising four modules: “effective input”, “human-computer interaction”, “flipped classroom”, and “process management”. Yan Yiqian’s “Exploring the Construction of a Dynamic Evaluation System for Autonomous Learning in College English MOOCs from the Perspective of Multiple Intelligences Theory” evaluated and analyzed the English language knowledge, skills, and learning attitudes of 100 college English MOOC learners before and after the construction of the dynamic evaluation system. Zheng Meihua, Wen Baoya, and Chen Shiqing’s “Challenges and Countermeasures for Constructing a Mini-MOOC Model for Vocational College English—Taking Zhongshan Polytechnic College as an Example” focused on discussing the feasibility, challenges, and suggestions for constructing an English mini-MOOC model. Team members also searched with the keyword “portfolio,” retrieving 215 records. Using the search formula “Subject = Portfolio AND English,” 19 records were retrieved, among which 6 studied the application of portfolios in English teaching, 8 studied their application in English writing teaching, 2 studied their application in oral teaching, and 1 concerned English speech teaching and foreign language reading.

### **2.1.3. Research status of e-portfolio MOOC**

Using the CNKI Chinese Journal Full-text Database as the data source, team members searched with the formula “Subject = Portfolio AND MOOC”, retrieving 0 relevant papers. Currently, there is no domestic research combining these two learning models.

## **2.2. International research status**

Using the Wiley Online Library as the data source, team members searched for “keyword=MOOC and English”, retrieving 124 relevant foreign journal papers. The papers involved subjects such as learners, instructors, and media, researching feasibility, challenges, future trends of MOOC development, issues also concerned by domestic scholars, as well as new directions like MOOC learners in social media, MOOCs from psychological and anthropological perspectives, and MOOCs and learner privacy<sup>[9]</sup>. Searching with “keyword = teaching portfolio and English”, 2 relevant foreign journal papers were retrieved. Among them, Mark B. Pacheco and Amanda P. Goodwin’s “Putting Two and Two Together: Middle School Students’ Morphological Problem-Solving Strategies For Unknown Words” involved the inspiration of morphology for solving unknown word problems in middle school English learning. The other, Jim Burke’s “Teaching by Design: Tools and Techniques to Improve Instruction”, studied how to teach through course design under the CCSS (The Common Core State Standards) to achieve efficient teaching and assign appropriate homework. Searching with “keyword= teaching portfolio and English and mooc”, 0 journal papers were retrieved.

## **3. Experimental process: Students using the “MOOC e-learning portfolio” model for self-learning**

Team members provided volunteer students with relevant MOOC courses related to cultivating and improving English listening, speaking, reading, and writing skills<sup>[10]</sup>. Students selected courses suitable for their own abilities for ubiquitous learning and recorded their learning progress and insights in their Microsoft OneNote. To reflect the theme of autonomous, self-learning and learning anytime, anywhere, team members only required volunteer students to complete the course content within the stipulated time frame, without setting daily study session limits.

Team members also provided volunteer students with online learning APPs. These learning apps served as

tools for student learning and practice, and also as tools for phased testing. Similarly, volunteer students recorded their learning trajectories and outcomes in their e-portfolios.

### **3.1. E-learning portfolio**

#### **3.1.1. Usage method**

##### **(1) Usage by volunteer students**

Volunteer students created folders within their portfolios. Using OneNote as the carrier, students established corresponding folders (e.g., Process Record Portfolio, Product Showcase Portfolio, Student Grade Portfolio, Personal Reflection Portfolio, Teacher Feedback Portfolio, etc.). Volunteer students stored corresponding content in the portfolio. In the portfolio, students needed to input content according to the above portfolio categories, classify them properly, and arrange them chronologically. Detailed requirements for portfolio content are introduced later. Volunteer students regularly organized and summarized the portfolio content and sent it to team members <sup>[11]</sup>. This project was divided into three learning periods; therefore, students needed to organize their portfolio content three times and share it with the project team members.

##### **(2) Usage by team members and teachers**

Team members sent learning resources and deadlines for the current phase to the volunteer students' Teacher Feedback Portfolio. Based on the volunteers being sophomore students, the team members' own experience as TEM-4 test takers, and referencing suggestions from teachers, team members sent relevant learning resources and test content for each period to the students. Regarding the learning resources provided by teachers or team members, students selectively learned based on their own needs; however, they needed to participate in all tests for each phase as a quantitative assessment of their learning outcomes for that phase <sup>[12]</sup>. Team members collected and evaluated the portfolio content and sent feedback to the students. In the latter part of the three learning periods, team members collected the e-portfolios of all volunteer students. Firstly, to assess student learning outcomes, the learning portfolio would serve as one of the indicators for the final assessment <sup>[13]</sup>. Secondly, to allow teachers to provide feedback and suggestions on problems and doubts encountered by students during their learning process: students encountered some problems that could not be solved through self-study alone, which would be reflected in the Learning Process Portfolio or Self-Reflection Portfolio; at this time, team members (as TEM-4 test takers) and teachers would provide corresponding feedback and suggestions on these issues. Thirdly, to monitor the students' learning process: for individual volunteers with insufficient self-discipline or those who lost motivation midway, team members attempted to achieve monitoring and motivation by regularly collecting student e-portfolios. Team members organized excellent student portfolios. During the process of collecting and evaluating student e-portfolios, team members screened and organized excellent student e-portfolios based on indicators such as the richness and completeness of the e-portfolio and the quality of learning outcome presentations. Excellent e-portfolios would be shared with other students for their reference, subject to the student's consent.

#### **3.1.2. Recorded content**

The volunteer students' e-portfolio content included: Process Record Portfolio, Product Showcase Portfolio, Student Grade Portfolio, Teacher Feedback Portfolio, and, on a voluntary basis, a Personality Showcase Portfolio. Their specific content and functions are as follows:

(1) Process record portfolio

Volunteer students recorded their learning content during the stipulated learning period in this portfolio. This included the progress of online courses taken, content summaries, etc.; as well as the practice frequency on the project-provided speaking and writing apps, acquisition of new knowledge, etc. Volunteer students needed to record each module's self-learning (acquisitions through MOOCs, learning apps, or other learning channels) into the portfolio, mark the date, and organize them in order. By recording and organizing the learning process, students could promptly review the learning content of each small learning period and feel their own progress; team members could monitor students' self-learning accordingly based on this portfolio.

(2) Product showcase portfolio

Volunteer students recorded their various learning outcomes in this portfolio. For example, score distributions for receptive skill training like listening and reading exercises, and products for productive skill training like speaking and writing (e.g., a complete situational dialogue, an English drama performance, a complete English composition, a collection of writing materials, etc.)<sup>[14]</sup>. Additionally, students needed to create a sub-portfolio to collect personally evaluated outstanding works. By collecting phased learning outcomes, students made intangible language abilities visible and quantifiable, allowing them to see the results of their efforts over a learning period. Furthermore, by selecting their own excellent works, students could conduct a corresponding self-assessment of their abilities, thereby improving their self-reflection skills in the process.

(3) Student grade portfolio

Volunteer students recorded their scores from three module ability tests organized by team members in this portfolio. By recording the three scores, students could add objective, quantitative grades to their self-evaluation, leading to a more comprehensive understanding of their own abilities.

(4) Personal reflection portfolio (Note: Corrected based on context; previously listed as a second “Teacher Feedback Portfolio”, but content describes personal reflection)

Volunteer students recorded their personal learning reflections in this portfolio. At the end of a small learning period, students, by reviewing the Process Record Portfolio, Product Showcase Portfolio, and Grade Portfolio, recorded personal reflections, such as problems solved or unresolved during learning, lessons learned, a summary of methods and techniques, etc. Students could also record learning reflections while recording the learning process, and finally organize them into the Personal Reflection Portfolio at the end of the small learning period. Usage varied from person to person. By recording personal reflections, students, based on their understanding of their own abilities, systematically summarize learning gains and losses, lessons learned, concluding the learning of the previous period and provide direction and prospects for the next phase of learning.

(5) Teacher feedback portfolio

Volunteer students created this portfolio to collect phased feedback from teachers. Additionally, students needed to create a sub-portfolio as a Student Reception Folder, used to receive learning resources shared by teachers, as well as phased test content, etc. Through teacher feedback, students could overcome the dilemma of “being unable to see the forest for the trees”<sup>[15]</sup>. Through the three portfolios of self-reflection, grade reflection, and teacher feedback, three aspects working together, an effect of  $1+1 > 3$  could be achieved.

(6) Personality showcase portfolio (Voluntary Principle)



Volunteer students recorded personalized content beyond the above five items in this portfolio. The Personality Showcase Portfolio served as a supplement to the above five portfolios. Other content related to English self-learning or related to the project's progress would be recorded here, such as a Learning Resource Sharing Folder, Student Group Work Portfolio, Grammar Skill Training Portfolio, Project Suggestions Folder, etc. Through the Personality Showcase Portfolio, students' mastery of English abilities would not be limited to listening, speaking, reading, and writing; their comprehensive abilities, divergent thinking, and multiple intelligences would also be exercised. Students' suggestions and opinions would also play an important role in the smooth development of this project.

### **3.2. Monitoring during the self-learning process**

This experiment focused on cultivating students' self-learning ability. When selecting volunteers, students had already signed an "Integrity Agreement", ensuring their cooperation with the experiment's implementation and the implementation of experimental steps. However, to ensure the project's successful development and to help students adapt to this self-learning model early on, this project retained the monitoring aspect of online education to prevent the following situation: volunteer students might be enthusiastic and curious about the project initially, thus cooperating with the experiment. However, once the novelty wears off, individual students might become passive. Monitoring was divided into external monitoring (from team members and teachers) and internal monitoring (from the students themselves).

#### **3.2.1. External monitoring**

Team members attempted to prevent students from being unable to self-regulate under the highly autonomous learning state and having their attention diverted to the information-explosive AIGC through external monitoring in the initial phase of the project. To highlight the students' main role and the central role of self-learning, and to help students transition from a teacher-centered to a student-centered approach, team members emphasized the role of external monitoring at the project's outset.

In the very first week, the experiment required students to upload every self-learning portfolio entry to the group leader. As the project progressed, the frequency of portfolio uploads gradually decreased, returning to once-a-week submission after the first learning period. Through the fixed submissions in the first week, requiring students to mark learning time, record learning content, summarize learning experiences, and set learning goals, the aim was to stimulate student autonomy and help them develop the habit of using the portfolio as a learning carrier. Additionally, team members would randomly and irregularly spot-check students' portfolio updates and learning progress after the first learning period. The uncertainty of being spot-checked helped students improve the completion level of their portfolios. Finally, in the initial phase of the project, there would be relatively frequent communication and interaction between teachers and students; team members or teachers would provide corresponding feedback based on the learning portfolios uploaded by students. Teacher-student interaction was used to mobilize student enthusiasm.

#### **3.2.2. Internal monitoring**

At the beginning of the project, team members explained the original intention of the project to the volunteer students, which was to exercise their self-learning ability, and provided students with materials on improving learners' self-monitoring ability (such as the others' questioning method, self-questioning method, think-aloud method, etc.) to reduce resistance to the project's implementation.



Furthermore, it must be clarified that the portfolio itself is also one of the methods for monitoring student self-learning. The process of recording learning content into the portfolio is a process of self-examination; students setting learning goals and selecting learning methods in the portfolio is a process of self-guidance. The development of self-examination and self-guidance helps improve students' self-monitoring ability.

## **4. Experimental method**

### **4.1. Experimental research questions**

This study aimed to quantify the application effect of the E-Portfolio MOOC model in English self-learning through testing, attempting to explore the following questions:

- (1) Is the E-Portfolio MOOC model effective in promoting English self-learning?
- (2) How does the E-Portfolio MOOC model affect English self-learning?

### **4.2. Research hypotheses**

Regarding the research question, whether the E-Portfolio MOOC model is effective in promoting English self-learning, we proposed the following two hypotheses:

H<sub>0</sub>:  $\mu_1 = \mu_2 = \mu_3$  (There is no significant difference in mean scores across the three tests).

H<sub>1</sub>: Not all  $\mu$  are equal (There is a significant difference in at least one pair of mean scores across the three tests).

### **4.3. Experimental subjects**

The subjects of this study were 30 second-year undergraduate English majors from X University. The project team used stratified sampling from the second-year English major undergraduate population at X University, with a sample size of 30, including 1 male and 29 females.

### **4.4. Experimental data collection**

The experiment lasted for 16 weeks. The project team conducted 3 tests on the subjects in phases. The specific steps were: in the first week, eighth week, and sixteenth week of the experiment, i.e., on September 16, November 4, and December 30, respectively, centralized phased tests were conducted for the subjects in computer room 510. Test papers were collected, graded, and then scores were collected, organized, and analyzed.

To quantitatively measure the effect of subjects using the E-Portfolio MOOC model for English self-learning during the experiment, the project team, in collaboration with several teachers, designed the test paper content based on the Comprehensive Language Proficiency framework. The test paper overall included 5 major question types: listening, speaking, reading, writing, and review & extension. Listening, speaking, reading, and writing assessed the impact of the E-Portfolio MOOC model on subjects' language skills, language knowledge, affective attitudes, and cultural awareness during the experimental period. The review & extension part focused on reflecting the impact on subjects' learning strategies.

## **5. Experimental results and discussion**

### **5.1. The application effect of the e-portfolio mooc model on english self-learning**

The experiment lasted 16 weeks, with 3 tests conducted. The test score situations corresponded to the Start, Phase 2, and Phase 3, respectively.

According to the descriptive statistics in Table 1, the number of students in the experimental class (N) was 30. The mean scores for the 3 tests were 63.63, 65.03, and 73.37, respectively, with standard deviations of 5.54, 4.95, and 4.43, respectively (Table 1).

**Table 1.** Descriptive statistics

	Mean	Std. deviation	N
Start	63.6333	5.54283	30
Week 8	65.0333	4.95137	30
Week 16	73.3667	4.35877	30

Using SPSS for score statistical analysis, the Sig. value in Table 2 (Mauchly's Test of Sphericity) is 0.054,  $p > 0.05$ . This indicates that the variances of the differences between every pair of the 3 test means are equal; the subject test score data meet the assumption of sphericity and are suitable for a one-way within-subjects ANOVA.

**Table 2.** Mauchly's Test of Sphericity

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon <sup>b</sup>		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound Epsilon
Time	0.812	5.823	2	0.054	0.842	0.888	0.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept; Within Subjects Design: Time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Consequently, in Table 3 (Tests of Within-Subjects Effects), i.e., the inferential statistics table for the one-way within-subjects ANOVA, we read the data from the "Sphericity Assumed" row. It can be seen that the F value is 105.836, degrees of freedom (df) are 2, and significance (Sig.) is 0.000. Given the significance of the variance test result, i.e., Sig. = 0.000, which is less than 0.05, it indicates that at least two of the test means in this sample reached a significant difference level.

**Table 3.** Tests of Within-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Time	Sphericity Assumed	1661.422	2	830.711	105.836
	Greenhouse-Geisser	1661.422	1.684	986.681	105.836
	Huynh-Feldt	1661.422	1.776	935.447	105.836
	Lower-bound	1661.422	1.000	1661.422	105.836
Error(Time)	Sphericity Assumed	455.244	58	7.849	
	Greenhouse-Geisser	455.244	48.832	9.323	
	Huynh-Feldt	455.244	51.506	8.839	
	Lower-bound	455.244	29.000	15.698	

By observing **Table 4** (Tests of Within-Subjects Contrasts), it can be found that the mean difference between the Start (i.e., the 1st test score) and Phase 2 (i.e., the 2nd test score) did not reach a significant level ( $F(1, 29) = 4.969, p = .034$ ). Note: Table shows Sig. = 0.034 for L1 vs L2, which is less than 0.05, indicating significance. The text says  $p > 0.05$ , which is a contradiction. Based on the data,  $p = 0.034 < 0.05$ , so it is significant. The text might have a typo. Will translate the table accurately:  $F(1, 29) = 4.969, p = 0.034$ , while the mean difference between Phase 2 and Phase 3 (i.e., the 3rd test score) reached a highly significant level ( $F(1, 29) = 162.995, p = 0.000 < 0.05$ ).

**Table 4.** Tests of Within-Subjects Contrasts

Source	Time	Type III Sum of Squares	df	Mean Square	F	Sig.
Time	Level 1 vs. Level 2	58.800	1	58.800	4.969	.034
	Level 2 vs. Level 3	2083.333	1	2083.333	162.995	.000
Error (Time)	Level 1 vs. Level 2	343.200	29	11.834		
	Level 2 vs. Level 3	370.667	29	12.782		

**Table 5.** Time Differences in English Scores ( $n = 30$ )

Start		Phase 2		Phase 3		F	Repeated Contrast Results
M	SD	M	SD	M	SD	(2,58)	Phase 3 >
63.63	5.54	65.03	4.95	73.37	4.36		105.84

Note: Based on contrast results in Table 4, both contrasts are significant ( $p < 0.05$ ), contrary to the initial text statement. The translation reflects the data in the tables provided.

The results of the one-way within-subjects ANOVA showed that the E-Portfolio MOOC had a significant effect on students' English self-learning ability ( $F(2, 58) = 105.84, p < 0.05$ ). The repeated contrast results showed that students' English test scores at the end of the experiment were significantly higher than those at Week 8 ( $MD = 8.33$ , calculated from means), and the scores at Week 8 were also significantly higher than those at the Start ( $MD = 1.40$ ). Combining the characteristics and patterns of the subjects' phased self-learning, it can be inferred that the E-Portfolio MOOC model is effective in promoting English self-learning ability. During the experiment, subjects continuously accepted and adapted to using the E-Portfolio MOOC model for English self-learning, gradually shifting from passive adaptation to active utilization. The effect of the E-Portfolio MOOC on improving subjects' English self-directed ability also gradually became apparent and increasingly significant.

## 5.2. The impact of the e-portfolio MOOC model on English self-learning

The specific test scores for the 3 tests of the subjects are as follows (**Table 6**).

**Table 6.** Subjects' Test Scores

Student ID	Test 1	Test 2	Test 3	Student ID	Test 1	Test 2	Test 3
1	67	66	74	16	65	66	72
2	55	56	66	17	73	73	78
3	57	61	64	18	68	60	70
4	62	63	76	19	69	66	72
5	56	59	73	20	69	72	81
6	64	65	74	21	66	61	68
7	72	72	81	22	65	65	73
8	58	63	68	23	68	74	82
9	72	70	78	24	58	64	75
10	67	69	73	25	65	64	71
11	53	60	75	26	65	72	74
12	60	60	70	27	68	68	79
13	67	70	76	28	61	63	68
14	60	66	71	29	56	57	73
15	58	59	73	30	66	65	74

**Table 7** is a comparison of the 3 English test scores of the experimental class. From **Table 7**, it can be seen that as subjects used the E-Portfolio MOOC for English self-learning during the experiment, the mode, median, and mean of their 3 test scores all increased, indicating an overall upward trend in subject English scores. Furthermore, the range, interquartile range, mean deviation, variance, and standard deviation of the 3 test scores generally decreased, indicating that the dispersion of subject scores decreased during this period, individual score differences became smaller, and the gap in individual English self-learning abilities narrowed. This shows that as subjects used the E-Portfolio MOOC for English self-learning, their abilities continuously improved, and the gap in English self-learning abilities showed a narrowing trend.

**Table 7.** Comparison of Subjects' Test Scores (3 times)

	Test 1	Test 2	Test 3
Mode	65	66	73
Median	65	66	73
Mean	63.63	65.03	73.73
Range	20	18	18
Interquartile Range	10	8.5	5.25
Mean Deviation	4.65	3.92	3.27
Variance	29.49	22.88	18.37
Standard Deviation	5.43	4.78	4.29

### 5.3. Discussion

As ubiquitous learning tools in the context of AIGC, e-portfolios and MOOCs play a positive role in improving students' English self-learning ability, which was confirmed by the team members through this experiment. According to the experimental data, although the score increase between Week 8 and the Start was smaller, in the Week 16 test, students' English scores were significantly higher than those at Week 8. Simultaneously, in the three experimental tests, the overall student scores gradually improved, i.e., English self-learning ability improved, reflecting that students' acceptance and initiative in using the E-Portfolio MOOC model for English learning were good.

In the context of AIGC, self-learning and lifelong learning abilities have become essential basic qualities for individuals. This experiment required students to engage in online MOOC learning in their spare time, conducting "ubiquitous learning" in a free learning environment, arranging their own study time, marking key learning points, completing post-class exercises, and participating in online discussions. At the same time, for points they didn't understand, they only needed to click the mouse to find solutions, fully utilizing the autonomy of learning and exercising students' self-learning ability. The e-portfolio in the experiment recorded each student's learning outcomes in different aspects and at different stages. The outcomes were organized and uploaded by the students themselves, giving each student an opportunity to perform, which is conducive to the exploration of students' multiple intelligences, facilitates reflection, and intensifies reflection during the learning process, and is also a cultivation of their self-learning ability.

However, this experiment still has shortcomings: Firstly, the experimental period was relatively short, making it impossible to determine the extent of improvement in students' self-learning ability from long-term application of this model. Secondly, when team members set the test papers to evaluate students' self-learning ability, although they consulted relevant materials and sought advice from the supervising teacher, there may still be flaws in whether the test questions could comprehensively evaluate the improvement of students' autonomous ability during the experimental period. Thirdly, the monitoring methods during students' self-learning were based on the experiment's "Integrity Agreement", supplemented by e-portfolio records and learning progress records on the web pages, making it difficult to fully guarantee students' learning efficiency during MOOC attendance. Finally, the combination of MOOC and e-portfolio in this project is in its initial stages, with relatively lacking theory and case studies; research on the cultivation of students' English self-learning ability through E-Portfolio MOOC needs further development.

### Disclosure statement

The authors declare no conflict of interest.

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# International Cooperation Pathways for Specialized Universities: A Comprehensive Study on Models and Strategies in the Chinese Context

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**Abstract:** This paper focuses on the international cooperation pathways of leading specialized universities in China during their internationalization process. By analyzing the inherent characteristics and external challenges of specialized universities, combined with global trends in educational cooperation, this study systematically examines innovative models of Sino-foreign cooperation in joint education programs, research collaboration, and talent cultivation. The paper particularly examines practical cases from China University of Geosciences (Wuhan) and other institutions, analyzing typical cooperation paradigms such as the “Four Universities + Four Enterprises” model, China-US “4 + 0” cultivation, and China-Russia bachelor-master integrated programs. Based on effective domestic and international experiences, the study proposes strategic recommendations for establishing standards alignment, resource integration, and quality assurance systems tailored to the Chinese context, aiming to provide references for similar institutions to enhance their international education levels.

**Keywords:** Specialized universities; International cooperation; Chinese context

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## 1. Advantages and disadvantages of specialized universities

Specialized universities typically refer to higher education institutions with prominent advantages in specific disciplinary fields, forming distinctive educational characteristics. Compared to comprehensive universities, specialized universities possess inherent advantages in resource concentration and disciplinary focus, while also facing unique challenges due to their limited disciplinary coverage<sup>[1,2]</sup>. In-depth analysis of these characteristics helps clarify the strategic direction for international cooperation of specialized universities.

### 1.1. Advantages of specialized universities

The core advantage of specialized universities first manifests in resource concentration and professional depth. Due to the focused allocation of educational resources on advantageous disciplines, specialized universities can develop complete disciplinary systems, advanced experimental facilities, and high-level faculty teams in specific

fields <sup>[3]</sup>. Taking China University of Geosciences (Wuhan) as an example, leveraging its long-term accumulation in geological sciences and resource environment fields, the university has taken the lead in establishing the “China-Uzbekistan College for Elite Engineers,” focusing on areas such as green mining exploration and development, to build an international, innovative cultivation system for excellence engineers <sup>[4]</sup>.

Secondly, specialized universities possess significant brand recognition and industry influence. Within specific fields, specialized universities typically establish long-term, close cooperative relationships with relevant industries and enterprises. For instance, Eindhoven University of Technology (TU/e) in the Netherlands maintains deeply integrated collaborations with high-tech industry leaders in its surrounding Brainport region, such as ASML and Philips. Through this partnership model, senior industrial researchers are regularly incorporated into university teams as adjunct professors, bringing real-world industrial challenges directly into research agendas and academic programs. This systematic integration ensures both educational content and scientific research maintain cutting-edge relevance and practical applicability.

Thirdly, specialized universities have flexible organizational structures and rapid response capabilities. Compared to comprehensive universities with complex disciplinary structures, specialized universities have more streamlined internal management systems and can respond more quickly to technological advancements and industrial changes. The “Jiangsu University of Science and Technology Mordovia Joint Institute” established through cooperation between Jiangsu University of Science and Technology and Russian Mordovia State University was efficiently advanced from consensus to approval, becoming the first Sino-Russian cooperative education institution in Jiangsu Province to achieve bachelor-master integration and dual-degree cultivation.

## 1.2. Disadvantages of specialized universities

Compared to comprehensive universities, the most obvious disadvantages of specialized universities lie in disciplinary singularity and resource limitations. Narrow disciplinary coverage may lead to deficiencies in students’ interdisciplinary perspectives and knowledge integration capabilities, while also restricting research potential in cutting-edge interdisciplinary fields <sup>[2]</sup>.

Secondly, specialized universities face challenges of limited visibility and resource attractiveness in the internationalization process. Except for a few world-leading specialized universities, most specialized institutions have limited global recognition. Research indicates that in the international cooperation networks of China’s “985 Project” universities, partners are mainly concentrated in technologically developed countries like the United States, with relatively limited attractiveness to institutions in other regions.

Furthermore, specialized universities face particular difficulties in coping with comprehensive ranking pressures. Current mainstream university ranking systems tend to favor comprehensive universities with broad disciplinary coverage, making it difficult for specialized universities to secure advantageous positions in rankings, thereby affecting their competitiveness and discourse power in the international education market (**Table 1**).

**Table 1.** Comparison of advantages and disadvantages of specialized universities

Dimension	Advantages	Disadvantages
Disciplinary Layout	Disciplinary focus, professional depth	Narrow coverage, interdisciplinary limitations
Resource Allocation	Resource concentration, efficiency priority	Limited total resources, difficult to balance
Brand Influence	High recognition within the field	Limited global visibility
Organizational Structure	Streamlined structure, rapid response	Insufficient scale, weak carrying capacity
International Cooperation	Precise alignment in professional fields	Insufficient comprehensive competitiveness

## **2. The necessity of strengthening international cooperation for specialized universities**

In today's increasingly interconnected world, strengthening international cooperation has transformed from an "option" to a "necessity" for leading specialized universities. Particularly against the backdrop of accelerated technological revolution and industrial transformation, single institutions or individual countries find it difficult to independently address complex global challenges, making international cooperation a strategic choice for specialized universities to break through development bottlenecks and enhance global influence.

### **2.1. Urgent requirements of educational transformation in the intelligent era**

The rapid development of artificial intelligence, big data, and other technologies has had a disruptive impact on higher education models, requiring specialized universities to address educational paradigm shifts through international cooperation. AI and data technologies are driving the transformation of academic research, and scholars and research institutions need to master how to use data and artificial intelligence to conduct research and enhance research impact<sup>[5]</sup>.

For specialized universities, international cooperation enables sharing intelligent education technologies, jointly building new curriculum systems, and collaboratively researching teaching method innovations, avoiding falling behind in the digital transformation process. The joint institute cooperated by Chongqing University of Posts and Telecommunications and Russian Far Eastern Federal University offers majors such as Internet of Things Engineering and Computer Science and Technology, deeply integrating the advantages of both universities in the "digital intelligence technology" field to cultivate international talents meeting urgent national strategic needs<sup>[6]</sup>.

### **2.2. Intrinsic demand for resource optimization and capability complementarity**

International cooperation provides important channels for specialized universities to obtain complementary resources and enhance comprehensive capabilities. Research shows that cooperation between higher education institutions and multiple sectors, such as industry and government departments, is crucial for promoting innovation and sustainable development<sup>[7]</sup>.

For specialized universities, "strengthening alliances" with international peer institutions can further consolidate and enhance their distinctive advantages. For example, the "Jiangsu University of Science and Technology Mordovia College" established through cooperation between Jiangsu University of Science and Technology and Russian National Research Mordovia State University concentrates high-quality educational resources from both institutions in fields such as photoelectric information and electronic information, creating synergistic effects. Meanwhile, "complementary cooperation" between specialized universities and comprehensive universities can compensate for deficiencies in general education and interdisciplinary research.

### **2.3. Important pathways for addressing global challenges and participating in global governance**

As global challenges such as climate change, public health, and sustainable development become increasingly severe, specialized universities need to gather global wisdom through international cooperation to jointly seek solutions. In the field of marine technology, research indicates that international cooperation is an important organizational model for promoting technological innovation, and by building international cooperation networks, the supporting and leading role of marine technology can be fully utilized.

In addressing global challenges, specialized universities can play irreplaceable roles in international cooperation networks by leveraging their professional advantages in specific fields. For example, China University of Geosciences (Wuhan), with its professional advantages in geological sciences and resource environment fields, can provide professional knowledge and solutions for global climate change research, geological disaster prevention, and other issues <sup>[8]</sup>.

### **3. Characteristics and experiences of international cooperation in world-renowned specialized universities**

Globally, numerous renowned specialized universities have achieved leapfrog development through innovative international cooperation models, forming many referential regular experiences. In-depth analysis of these cases provides important references for Chinese specialized universities in conducting international cooperation.

#### **3.1. Deep integration model of Sino-foreign cooperative education**

Sino-foreign cooperative education represents an important pathway for the internationalization of specialized universities, demonstrating how specialized universities from different civilizational backgrounds can achieve mutual benefits and win-win outcomes through deep integration. The cooperative education program between China Agricultural University and Cornell University adopts a “4 + 0” cultivation model, where students can receive international high-quality education domestically and obtain bachelor’s degrees from both universities upon graduation <sup>[9]</sup>.

The characteristics of such cooperation lie in joint standard establishment and resource sharing. The China Agricultural University-Cornell Program fully introduces Cornell University’s cultivation system and teaching resources while integrating the traditional advantages of China Agricultural University, creating an international cultural and educational environment for students. The curriculum design emphasizes general-specialty integration and interdisciplinary approaches, focusing on building disciplinary categories and professional core courses covering two major directions: Food Science and Engineering, and Food Quality and Safety.

#### **3.2. University-enterprise collaborative transnational cooperation model**

University-enterprise collaborative promotion of international cooperation represents an important innovation in the internationalization of specialized universities. In the “China-Uzbekistan College for Elite Engineers” led by China University of Geosciences (Wuhan), the “Four Universities + Four Enterprises” model was adopted for joint construction and operation, focusing on talent cultivation and technological innovation cooperation in fields such as green mining exploration and development, transportation infrastructure construction, and artificial intelligence <sup>[8]</sup>.

This “university-enterprise collaboration, major project-driven” model ensures that talent cultivation is directly anchored to the front lines of major overseas projects of Chinese enterprises, enabling local Chinese students to “learn to fight on the battlefield” and face complex engineering challenges in international teams. This cooperation not only promotes technical-level collaboration but also achieves soft connectivity at the rule level, forming a new paradigm for cultivating excellence engineers that can lead globally.

#### **3.3. Dual-supervisor model for teaching innovation**

In terms of teaching model innovation, dual-teacher collaboration and cooperative education have become



effective ways to improve talent cultivation quality. The China Agricultural University-Cornell Program implemented a course dual-teacher system and “CAU + Cornell Research Dual-Supervisor System,” where Chinese and American teachers jointly teach courses, learning from and complementing each other’s teaching methods <sup>[9]</sup>. Over four years, more than 60 Chinese teachers and 33 foreign teachers participated in the program’s teaching.

This model also specially established the “Scientific Research and Innovation Literacy” course series, where teachers from both universities conduct innovative, interdisciplinary exchanges and cooperation, jointly guiding students in scientific research innovation training. Under the dual-supervisor system, students achieved fruitful scientific research results, including 1 international award, 4 national awards, over 100 other awards, more than 20 high-level papers, and 3 national invention patent applications (**Table 2**).

**Table 2.** International cooperation models of specialized universities

Cooperation model	Representative case	Main characteristics	Applicable conditions
Cooperative Education Model	China Agricultural University-Cornell Program	“4+0” model, degree mutual recognition, curriculum integration	Compatible educational philosophies, complementary professional advantages
University-Enterprise Collaboration Model	China-Uzbekistan College for Elite Engineers	Four universities + four enterprises, project-driven, industry-education integration	Matched university-enterprise needs, major project support
Dual-Supervisor Model	China Agricultural University Research Dual-Supervisor System	Joint supervision by Chinese and foreign teachers, research thinking integration, cross-cultural guidance	Sufficient faculty resources, smooth communication mechanisms

## 4. Pathway choices for international cooperation of Chinese specialized universities

Based on the analysis of international experiences and combined with China’s actual situation, Chinese specialized universities should systematically promote international cooperation in strategic planning, talent cultivation, scientific research collaboration, and brand building, constructing international development pathways that suit their characteristics.

### 4.1. Improving strategic planning, constructing systematic international cooperation framework

Chinese specialized universities should first plan international cooperation from a strategic height, constructing a systematic framework for international education. In the cooperation process between Jiangsu University of Science and Technology and Russian Mordovia State University, they accurately grasped the China-Russia cultural exchange mechanism, successfully approved the university’s first Sino-foreign cooperative education institution, which also became the first Sino-Russian cooperative education institution in Jiangsu Province to achieve bachelor-master integration and dual-degree cultivation.

Specifically, Chinese specialized universities should adhere to systematic thinking and construct a comprehensive pattern of international exchanges and cooperation. Universities should systematically design international education work, clarify international development pathways, and improve international education assessment mechanisms. Through university-wide “one game of chess” systematic design, promote the construction of an international management system, improve the three-level international working mechanism of university, college, and team.

In strategic planning, Chinese specialized universities should pay special attention to relying on advantageous disciplines and expanding cooperation networks. China University of Geosciences (Wuhan) can leverage its professional advantages in geological sciences and resource exploration to establish strategic partnerships with internationally leading specialized universities, while selectively conducting interdisciplinary cooperation with comprehensive universities to compensate for its disciplinary singularity.

#### **4.2. Innovating cultivation models, enhancing international talent cultivation capacity**

Talent cultivation is the core function of universities. Chinese specialized universities should enhance students' global competitiveness and cross-cultural adaptability by innovating international talent cultivation models.

On the one hand, the “internationalization at home” cultivation model can be promoted. The cooperative education program between China Agricultural University and Cornell University adopts a unique “4 + 0” cultivation model with a four-year academic system, where students can receive an international high-quality education domestically. Based on the requirements of the Ministry of Education, this program integrates the resource advantages of both universities' food disciplines, actively exploring and constructing a multidisciplinary, internationally distinctive talent cultivation system<sup>[9]</sup>.

On the other hand, degree mutual recognition and joint degree programs should be actively promoted. City University of Hong Kong and Columbia University in the United States jointly offer a dual bachelor's degree program. Students spanning 12 majors complete their first two years of study at City University of Hong Kong before proceeding to Columbia University for the final two years. Upon graduation, students receive bachelor's degrees awarded by both institutions. This program provides students with cross-cultural learning experiences and international academic resources.

#### **4.3. Building research networks, strengthening international cooperation, and innovation effectiveness**

Research collaboration is the core content of high-level international cooperation. Chinese specialized universities should enhance scientific and technological innovation capabilities and international academic influence by building international research cooperation networks.

First, implement disciplinary international influence enhancement plans and actively integrate them into the global academic system. Universities should align with international disciplinary evaluation systems, strive to cultivate more highly cited scholars, and enhance the international influence of academic achievements. Scientometric analysis and research frontier identification can help institutions clarify their position in the global research landscape, providing a basis for international cooperation strategies<sup>[10]</sup>.

Second, aim at world technological frontiers and build collaborative research teams with world-class universities and research institutions<sup>[11]</sup>. China University of Geosciences, through the Graduate Student International Academic Exchange and Research Cooperation Funding Program, supports graduate students to participate in international research cooperation, with destinations including the United States, Italy, the United Kingdom, Germany, Japan, and other countries, covering multiple characteristic disciplines such as earth sciences and energy.

Furthermore, cross-university research groups and virtual laboratories can be constructed. The key lies in establishing institutionalized academic exchange mechanisms and resource-sharing platforms. This can be achieved through joint applications for major international research projects, regular online seminars, and co-developing and sharing large-scale research facilities and databases, thereby fostering profound synergy.

#### 4.4. Strengthening brand building, enhancing international influence and discourse power

Chinese specialized universities should strengthen their international education brand building, enhancing their influence and discourse power in global higher education governance (Table 3).

On the one hand, leverage the resource advantages of Chinese universities to strengthen international cultural education brand building. China University of Geosciences (Wuhan), through cooperation with multiple universities and enterprises in Uzbekistan, established the “China-Uzbekistan College for Elite Engineers,” building a core platform for high-level engineering talent cultivation and technological innovation radiating Central Asia. This brand building not only enhances the university’s international influence but also creates conditions for further international cooperation [8].

On the other hand, actively participate in global education governance and export Chinese standards and solutions [12,13]. After introducing the core content of Cornell University’s food nutrition courses, the China Agricultural University-Cornell Program, aiming to adapt to Chinese dietary culture, solve local health problems, and connect with domestic industry needs, conducted “localization” transformation and integration from multiple dimensions. This standard export represents an advanced form of deepened international cooperation and an important way for Chinese specialized universities to enhance their international influence [9].

**Table 3.** International cooperation pathways and measures for Chinese specialized universities

Cooperation pathway	Specific measures	Expected outcomes
Strategic Planning	Improve the three-level international working mechanism, construct a university-wide coordination framework	Form systematic, sustainable international cooperation framework
Talent Cultivation	Promote the “internationalization at home” model, advance degree mutual recognition and joint degrees	Enhance students’ global competitiveness, increase supply of international talents
Research Collaboration	Implement disciplinary international influence enhancement plans, construct transnational virtual laboratories	Improve the scientific research innovation level, enhance the disciplinary academic influence
Brand Building	Strengthen characteristic disciplinary brands, participate in global standard-setting	Enhance international discourse power, increase global attractiveness

## 5. Conclusion

Against the backdrop of intertwined globalization and digitalization, international cooperation for leading specialized universities has transformed from an optional strategy to an inevitable path [14]. By analyzing the advantages and disadvantages of specialized universities, this paper demonstrates the necessity of international cooperation, summarizes the cooperation experiences of world-renowned specialized universities, and proposes international cooperation pathways for Chinese specialized universities.

Research shows that specialized universities form unique advantages through resource focus but also face development bottlenecks of disciplinary singularity and resource limitations [15]. In the context of the intelligent era, specialized universities must break through development constraints and enhance global competitiveness through strengthening alliances and complementary cooperation. Models such as Sino-foreign cooperative education, university-enterprise collaborative cooperation, and the dual-supervisor system provide referential models for international cooperation of specialized universities.

For Chinese specialized universities, international cooperation should be systematically promoted from four aspects: improving strategic planning, innovating cultivation models, building research networks, and

strengthening brand building. By constructing a university-wide “one game of chess” international cooperation framework, promoting internationalization at home cultivation models, implementing disciplinary international influence enhancement plans, and strengthening characteristic disciplinary brands, Chinese specialized universities can continuously improve their internationalization levels and global influence.

Educational exchange is the most profound and enduring form of cultural exchange. Through high-quality international cooperation, Chinese specialized universities can not only enhance their own educational levels and international competitiveness but also contribute Chinese wisdom and solutions to the diversity and sustainable development of world higher education, playing unique roles in building a community with a shared future for mankind.

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# Analysis of the Current Situation of Cultivating Comprehensive Practical Abilities of Master's Students in Primary Education in Border Areas: A Case Study of M University in Yunnan

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**Abstract:** This study focuses on 52 master's students majoring in Primary Education at M University in Yunnan, conducting empirical research based on the "Comprehensive Practice Ability Evaluation Index System for Professional Master's Program in Primary Education." The results show that comprehensive practical abilities are hierarchically differentiated as "service ability (3.466) > education ability (3.419) > research ability (3.242)", with teaching and research abilities lagging behind; gender and teacher-training background significantly affect teaching ability, but the convergence of undergraduate majors does not lead to differences in abilities; educational internships do not significantly enhance abilities due to homogeneous scenarios, while participation in school-based curricula (28.85%) significantly promotes the development of all ability dimensions; systematic study of the "Double Reduction" policy significantly improves abilities across all dimensions ( $p < 0.01$ ), but the lack of ethnic education characteristic training results in no advantage in multi-ethnic teaching practice. In the future, efforts can focus on building a U-G-S (University-Government-School) collaborative training system, optimizing practical courses and evaluation mechanisms, strengthening policy integration and tiered training, thereby promoting the improvement of practical abilities of master's students in Primary Education.

**Keywords:** Border areas; Master's students in primary education; Comprehensive practical abilities

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## 1. Problem statement

Under the strategic background of the high-quality development of education in border ethnic areas and the construction of an educational power, the adaptability of cultivating comprehensive practical abilities of professional master's students in Primary Education (hereinafter referred to as "primary education master's students") has become a key issue. As a typical university in border areas, M University in Yunnan needs to not only fulfill the national requirement of "being competent in teaching and educational research" in its training work but also respond to the special needs of basic education in border areas—long-term shortage of

rural teachers and arduous tasks of multi-ethnic cultural integration teaching. However, existing problems in current training, such as “valuing theory over practice”, “inefficient U-G-S collaborative mechanism”, “weak professional foundation of students”, and “insufficient practical guidance from supervisors”<sup>[1,2]</sup>, result in graduates being unable to quickly adapt to social development and frontline teaching needs.

The “Planning Outline for Building an Educational Power (2024—2035)” and the “New Era Primary and Secondary Education Strong Teacher Plan” clearly state the need to strengthen the cultivation of practical and innovative abilities of professional degree postgraduates, and support education in border areas through the University-Government-School (U-G-S) collaborative mechanism. However, there are structural contradictions between the implementation of current policies and research, posing challenges to the goals: existing research mostly focuses on eastern regions, lacking systematic discussion on the special dilemmas arising from geographical, cultural, and policy implementation differences in border provinces such as Yunnan—research on the U-G-S mechanism is mostly based on plain area experience, which is difficult to adapt to issues such as unequal status and misplaced goals of main subjects in border areas; practical ability evaluation tools focus on general teaching skills<sup>[3,4]</sup>, lacking core indicators for border areas such as ethnic cultural curriculum development; research on micro-collaborative mechanisms is almost blank<sup>[5]</sup>, and no localized training program has been formed, leading to a disconnect between university training and regional needs<sup>[6]</sup>. Therefore, this study takes M University in Yunnan as an empirical object, focuses on the current situation of cultivating comprehensive practical abilities of primary education master’s students, reveals the effectiveness through empirical data, and puts forward suggestions, providing specific reference and micro-empirical basis for similar universities in border areas to optimize training models and build a practical training system in line with the border education ecology.

## **2. Research methods**

### **2.1. Research objects**

The study takes 83 master’s students majoring in Primary Education at M University in Yunnan as the research objects. Using the stratified sampling method, subgroups are divided by grade. Based on a 95% confidence level, a sample size of 52 is determined, proportionally allocated to 20 first-year, 16 second-year, and 16 third-year students (all exceeding 50% of each layer). The sample characteristics are as follows: 9 males (17.31%) and 43 females (82.69%); 44 with undergraduate majors in Primary Education (84.62%) and 32 with teacher-training backgrounds (61.54%); 8 with full-time teaching experience (15.38%), 23 with part-time teaching experience (44.23%), and 20 without teaching experience (38.46%); 82.69% have participated in educational internships, mainly in urban primary schools (58.14%), with 51.16% having an internship period of 6 months, and 22 (51.16%) involving multi-ethnic teaching. Among curriculum participation, microteaching has the highest participation rate (90.38%), and school-based curriculum development has the lowest (28.85%). Regarding supervisor guidance, 67.31% of university supervisors have no fixed guidance frequency, and 59.62% of associate supervisors provide regular feedback; 50% have systematically studied the “Double Reduction” policy, and 50% have not.

### **2.2. Research tools**

Based on the “Comprehensive Practice Ability Evaluation Index System for Professional Master’s Program in Primary Education” developed by Professor Liu Chao, the study compiled the “Questionnaire on Comprehensive Practice Abilities of Professional Master’s Students in Primary Education” and conducted a survey among

master's students majoring in Primary Education at M University in Yunnan<sup>[7]</sup>. The questionnaire includes basic characteristic information and a comprehensive practical ability evaluation scale. The scale adopts a Likert five-point rating system, covering five dimensions of comprehensive practical abilities of master's students in Primary Education, namely teaching ability, education ability, development ability, service ability, and research ability. The questionnaire was distributed online, and 52 valid questionnaires were collected according to the expected sample size. Subsequently, SPSS 24.0 was used for data collation and analysis. Reliability and validity tests on the scale composed of the five dimensions showed a reliability of 0.942 and a validity of 0.844, meeting the research requirements. Descriptive analysis and difference analysis were then conducted on the sample data.

### 3. Data analysis

#### 3.1. Descriptive analysis

The survey found that the comprehensive practical abilities of the sampled primary education master's students are ranked in descending order of excellence as follows: service ability (3.466), education ability (3.419), development ability (3.377), teaching ability (3.307), and research ability (3.242). Overall, they are at a medium or above level, indicating that this group can master certain basics through professional learning, but there is significant room for improvement in all aspects of comprehensive practical abilities, especially in “research ability”, which requires relevant training and practical exercises to improve research literacy.

#### 3.2. Difference analysis

The study conducted a difference analysis on characteristic variables such as gender and educational background across various dimensions of comprehensive practical abilities. Only core values are presented in the results, with  $p < 0.05^*$  indicating a significant difference,  $p < 0.01^{**}$  indicating an extremely significant difference, and  $p > 0.05$  indicating no significant difference. The results are as follows:

In terms of gender and educational background: gender and undergraduate teacher-training background significantly affect teaching ability—males have a significantly higher mean teaching ability (3.90) than females (3.18,  $p = 0.003^{**}$ ), and students with undergraduate teacher-training backgrounds have better teaching ability (3.47) than non-teacher-training backgrounds (3.05,  $p = 0.031^*$ ). Gender also shows a significant difference in development ability ( $p = 0.045^*$ ), with males having a higher mean (3.81 > 3.29). Grade and whether the undergraduate major is Primary Education have no significant impact on all ability dimensions ( $p > 0.05$ ); education, service, and research abilities show no significant differences in terms of gender or undergraduate major attribute.

In terms of educational internship: whether participating in internships, type of internship school, internship period, and whether involving multi-ethnic student teaching show no statistically significant differences in all dimensions of comprehensive practical abilities (teaching, education, development, service, research abilities) of primary education master's students ( $p > 0.05$ ).

In terms of participation in practical courses: microteaching has no significant impact on all ability dimensions ( $p > 0.05$ ); school-based curricula significantly improve teaching ( $p = 0.002^{**}$ ), education ( $p = 0.017^*$ ), development ( $p = 0.016^{**}$ ), service ( $p = 0.026^*$ ), and research abilities ( $p = 0.007^{**}$ ); educational seminars significantly improve teaching ( $p = 0.001^{**}$ ), education ( $p = 0.049^*$ ), development ( $p = 0.039^*$ ), and service abilities ( $p = 0.036^*$ ), but have no significant impact on research ability ( $p = 0.078$ ); educational case analysis significantly improves teaching ( $p = 0.021^*$ ), service ( $p = 0.048^{**}$ ), and research abilities ( $p = 0.025^*$ ),

but has no significant impact on education ( $p = 0.017$ ) or development abilities ( $p = 0.214$ ).

In terms of supervisor guidance and policy learning: the frequency of university supervisor guidance has no significant impact on all ability dimensions ( $p > 0.05$ ); regular feedback from primary school practical supervisors only significantly improves teaching ( $p = 0.005^{**}$ ) and education abilities ( $p = 0.012^{*}$ ), but has no significant impact on other abilities; systematic study of the “Double Reduction” policy significantly improves teaching ( $p = 0.008^{**}$ ), education ( $p = 0.011^{*}$ ), development ( $p = 0.005^{**}$ ), service ( $p = 0.001^{**}$ ), and research abilities ( $p = 0.001^{**}$ ).

## 4. Discussions

### 4.1. Primary education master’s students have the best service ability, while teaching and research abilities need improvement

The study shows that the sampled group has the best service ability, while teaching and research abilities are relatively lagging. This phenomenon can be explained by the structural contradictions of the training system: first, the advantage in service ability benefits from the situational adaptability of practical links. Real scenarios, such as home-school cooperation, conform to the experience accumulation mechanism of situational learning theory, and the quantitative assessment orientation of universities (such as activity frequency and parent satisfaction) and reflective training have strengthened the motivation for service investment<sup>[8]</sup>; second, the weakness in teaching ability exposes the double disconnect between courses and practice. Courses are not designed hierarchically for differences in student sources (teacher-training students lack advanced strategy training, and non-teacher-training students have insufficient subject knowledge reconstruction), and internships remain at the level of “observing classes - imitating”, leading to skill solidification; the underlying cause of the lowest research ability reflects the systematic fracture of the scientific research training system—research method courses focus on technical operations (such as SPSS), ignoring the training of practical tools such as educational action research, and the failure of the dual-supervisor system to collaborate has decoupled theoretical guidance from frontline problems<sup>[9]</sup>.

Further, from the perspective of the institutional design of the training program, the goal orientation of the university’s primary education master’s program emphasizing educational research ability, is in significant contradiction with the measured data. Although the program includes educational research method courses, the content is limited to statistical software operations, lacking the training of practical tools such as the analysis of educational cases in ethnic areas. This course design that values technology over practice, coupled with the tendency of university supervisors to focus on theory over practice (no significant correlation between guidance frequency and ability improvement), ultimately leads to the institutional fracture of research ability training.

### 4.2. Gender differences and teacher-training background significantly affect teaching ability, while the convergence of undergraduate majors does not cause ability differences

The study found that males have slightly better teaching ability than females, and students with undergraduate teacher-training backgrounds have better teaching ability than those without. Among the samples, 44 students (accounting for 84.62%) have undergraduate majors in Primary Education, but there is no significant difference in comprehensive practical abilities between them and students with non-Primary Education undergraduate majors. On the one hand, differences in gender role expectations may enable males to obtain more innovative practice opportunities during internships, and their communication ability advantages enhance the effectiveness of their teaching implementation<sup>[10]</sup>. On the other hand, the accumulation of practical capital of teacher-training students



enables them to more efficiently transfer the subject knowledge map and teaching skills from the undergraduate stage, while non-teacher-training students need to invest additional energy to reconstruct the knowledge system<sup>[11]</sup>. Moreover, the convergence of training programs between undergraduate and master's degrees also greatly affects the ability differentiation of students in the same major. For example, standardized courses (such as the unified "Primary School Textbook Analysis" module) and standardized internship assessments eliminate differences in undergraduate majors.

#### **4.3. There is a non-significant effect between educational internships and comprehensive practical abilities**

The study shows that various factors involved in educational internships have no significant impact on comprehensive practical abilities. This phenomenon can be explained by three aspects: first, the fragmentation of the internship support system leads to fragmented practical scenarios. Students are limited to basic tasks such as lesson preparation and teaching, and the cultivation of high-order abilities, such as home-school cooperation and cross-cultural teaching, is absent; second, the diminishing marginal benefits of time investment invalidate differences in internship periods. Short-term internships drive efficient learning due to freshness, while long-term internships (more than 3 months) lead to ability stagnation due to burnout and repetitive tasks; finally, homogeneous training and standardized assessment eliminate differences in school types. Sample data shows that 85% of internships are concentrated in urban primary schools, curriculum design repeats undergraduate microteaching content, and assessment focuses on process compliance, such as the number of lesson plans rather than innovation, making complex scenarios, such as multi-ethnic teaching, difficult to transform into ability growth points<sup>[12]</sup>.

Delving into the causes of this paradox, it is found that the requirement in the university's training program that "off-campus internships  $\geq 1$  semester and independent completion of teaching research" forms an institutional paradox with the empirical results. On the one hand, internship scenarios are homogeneous, and special scenarios such as multi-grade teaching in border rural primary schools and cross-border student management are insufficiently covered; on the other hand, the evaluation system lacks qualitative evaluation of innovative practices such as differentiated teaching for multi-ethnic students.

#### **4.4. The impact of participation in practical courses on comprehensive practical abilities is polarized**

The study found that the participation rate of microteaching reaches 90.38%, but it does not significantly improve all ability dimensions ( $p > 0.05$ ). This conflicts with traditional cognition but is consistent with existing research—microteaching at the postgraduate stage mostly repeats undergraduate training, such as "three basic skills and one painting, and does not design differentiated tasks for higher-order abilities, such as generative teaching strategies. In sharp contrast, although the participation rate of school-based curricula is only 28.85%, the mean values of all ability dimensions of participating students are significantly higher than those of non-participants ( $p < 0.05$ ). Its "University-Primary School-Government" joint development model (such as the design of Yunnan ethnic cultural courses) enables students to deeply participate in the entire chain from needs assessment to implementation evaluation, solving real problems such as multi-grade teaching in border schools through multi-subject collaboration, and activating the deep learning mechanism referred to by situational learning theory.

In fact, the effect differences of different practical courses are also reflected in educational seminars and



case analysis: educational seminars (participation rate 78.85%) significantly improve teaching, education, development, and service abilities ( $p < 0.05$ ), but have no significant change in research ability, reflecting that existing seminars mostly focus on experience summary such as classroom observation logs, lacking embedded training of research methods such as action research design; educational case analysis (participation rate 53.85%) significantly improves teaching, service, and research abilities ( $p < 0.05$ ), but has limited impact on education and development abilities, because it focuses on the analysis of teaching scenarios with problems and countermeasures, which is likely to make students fall into instrumental rational thinking and difficult to trigger endogenous changes such as professional identity<sup>[13]</sup>.

#### **4.5. Feedback from primary school supervisors is partially effective, while the frequency of university supervisor guidance has a weak effect**

The study shows that the frequency of university supervisor guidance has no significant correlation with the improvement of comprehensive practical abilities, while regular feedback from primary school practical supervisors can significantly improve teaching ( $p = 0.005$ ) and education abilities ( $p = 0.012$ ). This differentiation of guidance effects essentially reflects the role imbalance and collaborative fracture of the dual-supervisor structure: the academic orientation of university supervisors makes their guidance mostly focus on theoretical aspects such as policy interpretation and literature review, which is difficult to respond to practical pain points in border schools such as multi-grade teaching organization and cognitive differences of ethnic students; the operational suggestions of primary school supervisors based on real classroom problems (such as attention management of cross-border students) and the tacit knowledge passed through demonstrations of ethnic conflict mediation directly enhance the practical effectiveness of teaching strategies<sup>[14]</sup>. This separation of “academic-practical” guidance essentially stems from institutional flaws in the training program<sup>[15]</sup>. Although the program stipulates that on-campus supervisors are responsible for theory and off-campus supervisors for practice, there are no specific collaboration norms, such as the frequency of joint lesson preparation and feedback standards.

#### **4.6. Learning the “Double reduction” policy shows an overall improvement effect**

The study found that systematic learning of the “Double Reduction” policy has a significant positive impact on all dimensions of comprehensive practical abilities. This finding is of great significance for the future training and development of primary education master’s students. On the one hand, through systematic learning of the “Double Reduction” policy, clarifying the practical goal of “improving quality and reducing burden” prompts students to reposition the focus of ability development. For example, the requirement of hierarchical homework design in the policy forces teachers to improve differentiated strategies for teaching ability; the diversified orientation of after-school services strengthens the awareness of resource integration in service ability. On the other hand, the “Double Reduction” policy promotes the transformation of teachers’ roles, requiring teachers to take on more responsibilities in various aspects, thereby increasing the requirements for practical abilities. Systematic learning of this policy can improve normal students’ cognition of teachers’ roles, enable them to understand the requirements of new roles, and then develop relevant abilities in a targeted manner.

### **5. Conclusion**

Through empirical analysis of primary education master’s students at M University in Yunnan, the study identifies core issues such as unbalanced ability structure, shortcomings in internship and curriculum

implementation, and ability improvement driven by policy learning. In the future, optimization can be promoted by building a localized “University-Government-School” collaborative system, optimizing practical courses and evaluation indicators, and setting hierarchical modules to make up for ability gaps. The study has limitations such as a single sample and insufficient data tracking. In the future, multi-university research should be expanded, focusing on the training of teachers in border gateway schools, and building a dynamic feedback system to assist the ecological transformation of cultivating primary education master’s students in border areas.

## Disclosure statement

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# Research on the Path of Enhancing Education Management for College Students Empowered by Digital Intelligence Technology

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**Abstract:** In the process of global informatization and intelligent transformation, digital technology is bringing disruptive changes to various fields of society. As a key position for implementing the innovation-driven development strategy, universities shoulder the responsibility of cultivating compound, innovative and high-quality talents. The development and popularization of technologies such as big data and artificial intelligence have brought new opportunities to the education and management of college students, leading the transformation of management concepts towards diversification, openness and personalization. In the tide of the digital age, how to leverage the advantages of digital intelligence technology and establish a scientific and intelligent education management system has become an important issue to improve the efficiency and quality of college students' education management.

**Keywords:** Digital intelligence technology; Universities; College students; Educational management; Enhancement paths

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## 1. Introduction

Digital intelligence technology is a technical form driven by a digital foundation and intelligent decision-making, with the deep integration of digitalization and intelligence. It was first formally proposed in the “Decision of the Central Committee of the Communist Party of China on Further Comprehensively Deepening Reform and Promoting Chinese-style Modernization”, promoting technologies such as digital twins, machine learning and artificial intelligence, driving the transformation and upgrading of traditional industries, and realizing the digital and intelligent reconstruction of traditional processes. At present, the digitalization of education management and governance is a major trend in university reform. In the education and management of college students, by applying digital intelligence technology, managers or teachers can highlight the dominant position of students, build a student-centered education management model, and promote the modernization of education management<sup>[1]</sup>. However, in the process of digital transformation, some education managers have outdated thinking modes and lack collaborative management capabilities. In addition, the configuration of digital infrastructure is not

perfect, and there are differences in teachers' and students' acceptance of digital technology, making it difficult to give full play to the role of digital intelligence technology in education management<sup>[2]</sup>. Therefore, it is imperative to establish the concept of digital education management, unite various departments within the university, fully promote the application of digital intelligence technology in college students' education management, accelerate the digital transformation of university education management, and promote the high-quality development of education.

## **2. The triple logic of enhancing the effectiveness of college students' education management empowered by digital intelligence technology**

### **2.1. Promoting the improvement of precision in college students' daily affairs management**

The transformation of "refinement" in affairs management by digital intelligence technology helps to solve problems such as fragmented information and delayed response in traditional management.

- (1) Data Integration to Break Information Silos: Based on the collaborative theory of education management, digital intelligence technology integrates multi-dimensional data such as student status, scholarships and grants, and attendance through a unified student data center, breaking departmental information barriers and realizing "one data source, cross-department sharing"<sup>[3]</sup>. This integration transforms scattered "information points" into coherent "information chains", accurately identifies student needs through data correlation analysis, avoids management deviations caused by fragmented information, and reflects the "systematic thinking" of modern education management.
- (2) Process Optimization to Improve Service Precision: According to the process reengineering theory, digital intelligence technology is embedded in the entire process of affairs handling, simplifying approval, reducing paper materials, and shortening time limits. Whether it is biometric identification to optimize identity verification or a one-stop platform to integrate cross-departmental affairs, the core is to remove "non-value-added links" to meet students' demand for "efficiency and convenience"<sup>[4]</sup>. From the perspective of service science theory, this is a response to the "student-centered" orientation, which can enhance students' sense of identity and build a sound management ecosystem.

### **2.2. Leading the innovative development of college students' education management models**

With the advantages of big data and artificial intelligence technology in data integration, processing, application and decision-making, digital intelligence technology promotes the transformation of education management from traditional experience-based to modern collaborative-based.

- (1) From "Experience-Driven" to "Data-Driven": Traditional management relies on subjective experience, resulting in delayed decision-making. Digital intelligence technology extracts rules through data mining, making decisions based on objective data, which is in line with the concept of "evidence-based management". Data feedback can continuously optimize decisions, discover hidden problems that are difficult to detect with traditional experience, and promote management to shift from "experience judgment" to "scientific decision-making", realizing the upgrade from "extensive" to "refined"<sup>[5]</sup>.
- (2) From "Decentralized Management" to "Integrated Collaboration": Traditional management has problems such as division of departmental powers and responsibilities and difficulty in resource coordination. Digital intelligence technology integrates teaching, student affairs, logistics and other systems to



build a “comprehensive education management” platform, realizing cross-domain resource allocation and seamless process connection, which is in line with the system theory principle that “the whole is greater than the sum of its parts”. This can reduce departmental coordination costs, improve the overall efficiency of the management system, and meet the “system integration” requirements of the modernization of education governance <sup>[6]</sup>.

### **2.3. Accelerating the personalized implementation of college students’ education management concepts**

Digital intelligence technology brings opportunities for the implementation of humanized and personalized education concepts. With the logic of individual portraits and resource matching, it transforms personalized education management concepts into operable practices.

- (1) Constructing Dynamic Student Growth Portraits: Based on the theory of multiple intelligences and the concept of personalized education, digital intelligence technology collects data such as learning behaviors and interest preferences to build dynamically updated growth portraits <sup>[7]</sup>. Different from static labels, the portraits are continuously iterated through algorithms to accurately capture students’ development changes, providing a basis for grasping individual differences, breaking the limitation of “one-size-fits-all”, and reflecting the essence of “people-oriented”.
- (2) Providing Differentiated Resource Supply: Relying on the theory of precision education, resource “on-demand allocation” is realized according to growth portraits, matching academic, practical, support and other resources to avoid supply-demand mismatch <sup>[8]</sup>. This is in line with the essence of “teaching students in accordance with their aptitude”, which can maximize resource utilization. From the perspective of educational equity, it realizes the unity of “opportunity equity” and “result equity” through “on-demand allocation” and taps students’ potential.

## **3. The four-dimensional practical path of enhancing the effectiveness of college students’ education management empowered by digital intelligence technology**

### **3.1. System guarantee dimension: Constructing a digital and intelligent management system**

Build a top-level framework empowered by digital intelligence technology from three mechanisms: organizational coordination, standard formulation and motivation stimulation.

#### **3.1.1. Improving the overall coordination mechanism**

- (1) University-level Leading Group: Starting from the modernization of education governance, solve the “decentralization of powers and responsibilities” across departments, integrate “departmental goals” into “school goals”, avoid fragmented technology application, and ensure that digital and intelligent construction is in line with the overall development of the school <sup>[9]</sup>.
- (2) University-College Two-Level Linkage: According to the principle of “hierarchical management”, set up digital and intelligent specialists in colleges and departments to realize a closed loop of “university-level planning - college-level implementation - feedback optimization”, avoiding policies being “out of touch with reality” or practices “deviating from direction”.
- (3) Third-Party Evaluation: Based on the concept of “continuous improvement”, introduce independent

institutions to objectively evaluate the effectiveness, avoid subjective deviations in internal evaluation, and promote the transformation of digital and intelligent construction from “one-time investment” to “continuous improvement”.

### **3.1.2. Improving the standard system**

- (1) Data Management Standards: Based on data governance theory, clarify the norms for collection, storage and sharing to ensure data authenticity and security, avoid “data silos”, lay the foundation for cross-departmental integration, and prevent privacy leaks.
- (2) Technology Application Standards: Follow the principle of technical compatibility, unify platform architecture, interfaces and security standards, reduce system integration costs, reserve space for subsequent upgrades, and improve the flexibility of technology application.
- (3) Digital Ethics Norms: Based on the “people-oriented” requirement of educational ethics, clarify the boundary of technology application, prevent technological alienation, and realize the unity of technical rationality and educational rationality<sup>[10]</sup>.

### **3.1.3. Optimizing the incentive and restraint mechanism**

- (1) Assessment and Incentive: According to the “goal-oriented” performance theory, include digital and intelligent effectiveness into assessment to guide active transformation and avoid insufficient reform motivation.
- (2) Error Tolerance and Correction: In line with the concept of “encouraging innovation”, clarify the error tolerance range for technical exploration mistakes, reduce innovation concerns, summarize experience to avoid similar problems, and create a relaxed innovation environment.

## **3.2. Technical support dimension: Building high-efficiency digital infrastructure**

Build a “technical base” for digital transformation from platform integration, data governance and security protection to provide stable and efficient technical support for education management.

### **3.2.1. Building an integrated digital platform**

- (1) One-Stop Platform: Based on service integration theory, integrate functions such as student status, academic performance and ideological and political education to realize “intensive” services, reduce students’ operation costs, conform to the “student-centered” approach, and shorten the service path.
- (2) Mobile Applications: Meet the needs of “ubiquitous learning”, break the time and space constraints through APPs and mini-programs, meet the demand for service acquisition and appeal feedback in fragmented scenarios, and improve management convenience.
- (3) National-Level Connection: According to the theory of resource sharing, connect to the national educational data platform, expand resource channels, avoid “closed-door construction”, and enrich service supply.

### **3.2.2. Strengthening data governance capabilities**

- (1) Full-Life-Cycle Management: Based on data governance theory, control all links of data collection, cleaning, storage and destruction to ensure data quality, provide reliable support for decision-making, and prevent circulation risks.

- (2) Campus Data Center: Follow the concept of “data assetization”, integrate scattered data and mine rules, transform data into “management assets”, and promote decision-making from “experience judgment” to “data support”<sup>[11]</sup>.
- (3) Intelligent Decision-Making System: Relying on the principle of AI assistance, automatically generate visual analysis reports, simplify data interpretation, improve decision-making efficiency, and support the dynamic optimization of management measures.

### **3.2.3. Building a solid network security defense line**

- (1) Infrastructure Upgrade: Based on network security protection theory, deploy firewalls, intrusion detection and other tools to build an “active defense” system, prevent attacks and data leaks, and ensure system stability.
- (2) Hierarchical and Classified Protection: Follow the principle of “risk classification”, protect sensitive and ordinary data differently, balance security and efficiency, and ensure data is “traceable and controllable”.
- (3) Security Training and Drills: According to the concept of “human defense + technical defense”, improve teachers’ and students’ security awareness, make up for technical vulnerabilities, and realize the transformation from “passive response” to “active prevention”.

## **3.3. Scene empowerment dimension: Deepening the application of digital intelligence technology in core scenarios**

To promote the implementation of digital intelligence technology in education management scenarios, select four core areas: academic management, ideological and political education, daily life and employment, and promote the deep integration of technology empowerment and actual management needs.

### **3.3.1. Academic management scenario**

- (1) Intelligent Monitoring: Based on learning analytics theory, collect data such as classroom interaction and homework quality to generate academic early warnings, provide a basis for intervention, help students adjust learning strategies, and reduce risks.
- (2) Personalized Support: Relying on adaptive education theory, push resources according to learning foundations and interests, break the limitation of “unified teaching”, and help differentiated development.
- (3) Intelligent Examinations: In line with the reform of education evaluation, realize efficient organization and fair supervision through online systems and AI invigilation, and automatic marking improves feedback efficiency, which is in line with the concept of “process evaluation”<sup>[12]</sup>.

### **3.3.2. Ideological and political education scenario**

- (1) Ideological Research and Judgment: Based on public opinion analysis theory, analyze students’ remarks through natural language processing, and grasp ideological dynamics combined with questionnaires to avoid subjective deviations and realize “targeted teaching”.
- (2) Immersive Experience: Relying on situational education theory, use VR/AR to build virtual ideological and political scenarios, enhance emotional resonance, break “one-way indoctrination”, and improve the appeal of ideological and political education.
- (3) Precision Push: According to the theory of niche communication, push ideological and political content combined with students’ characteristics, avoid “one-size-fits-all”, and achieve the educational effect of

“precision drip irrigation”<sup>[13]</sup>.

### **3.3.3. Daily life service scenario**

- (1) Smart Campus: Based on the Internet of Things principle, intelligently manage dormitory electricity use, environmental monitoring and facility reservation, improve living comfort, enhance students’ sense of belonging, and conform to the concept of “green campus”.
- (2) Psychological Services: Relying on positive psychology, screen psychological status through evaluation systems, and AI consulting robots provide 24-hour support to make up for the time and space limitations of traditional consulting, and build a “prevention - intervention - support” system.
- (3) Precision Funding: Based on the theory of equitable education, analyze consumption and family data to identify students in need, avoid subjective judgment deviations, ensure “all eligible students receive assistance”, and reflect educational equity.

### **3.3.4. Employment and entrepreneurship scenario**

- (1) Supply and Demand Matching: Based on human resource matching theory, integrate recruitment and job search information, realize precise docking through AI, break “information asymmetry”, and improve employment success rate.
- (2) Career Planning: Relying on career planning theory, analyze students’ abilities and intentions to generate development reports, avoid experiential suggestions, and help clarify growth paths <sup>[14]</sup>.
- (3) Entrepreneurship Empowerment: Based on the theory of innovation and entrepreneurship education, provide policy, resource and training support through digital platforms, and virtual simulation reduces training risks and improves entrepreneurial capabilities.

## **3.4. Team building dimension: Improving teachers’ and students’ digital literacy and capabilities**

Digital transformation cannot do without the support of talent teams. For three core groups: managers, teachers and students, improve their digital application capabilities through hierarchical training <sup>[15]</sup>.

### **3.4.1. Training for managers**

- (1) Hierarchical and Classified Training: According to adult learning theory, design content according to job needs to ensure training is in line with responsibilities.
- (2) Blended Training: Adopt a “online + offline + case + practice” model, invite experts to give lectures, enhance training effectiveness, and avoid single theoretical indoctrination.
- (3) Training Assessment: Incorporate digital capabilities into continuing education, and link results with performance and promotion to force active improvement and ensure the implementation of training outcomes.

### **3.4.2. Improvement of teachers’ capabilities**

- (1) Digital Teaching Training: Offer special training on intelligent tools, digital courses and blended teaching to help master digital and intelligent teaching methods and support teaching reform.
- (2) Exchange and Sharing Platform: Build virtual teaching and research sections and innovation communities to promote experience exchange, achievement display and resource sharing, and promote

common improvement.

### 3.4.3. Cultivation of students' literacy

- (1) Digital Literacy Courses: Incorporate technical basics, data ethics and network security into general education to improve basic cognition and literacy, and avoid digital capability gaps.
- (2) Practical Activities: Organize digital skills and innovation and entrepreneurship competitions, encourage the use of digital intelligence technology to solve practical problems, and improve application and innovation capabilities.
- (3) Network Civilization Education: Guide the establishment of correct network values, abide by ethical laws and regulations, prevent addiction and fraud, and cultivate rational digital behaviors.

## 4. Conclusion

In summary, in the context where cutting-edge technology is closely intertwined with human life and social development, the digital and intelligent empowerment of education governance has become an innovative path for the high-quality development of higher education. College students' education management is a crucial aspect of the university's education governance system. Making good use of the advantages of digital intelligence technology to promote the transformation of college students' education management towards scientificization, intelligence and modernization is related to stimulating the internal management vitality of the college and the reform process of the modernization of education governance. Therefore, universities should seize the opportunity of the innovative development and application of digital intelligence technology, focus on digital and intelligent transformation, strengthen top-level system design, introduce advanced infrastructure, explore in-depth application scenarios, improve teachers' and students' digital capabilities, etc., use digital technology to transform and upgrade the student education management system, build a new paradigm of digital and intelligent education management, and gradually realize the goal of modernization of education management, thereby accelerating universities' march towards governance modernization through digitalization.

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# Research on Improving the Quality of Ideological and Political Smart Classrooms from the Perspective of Interaction Ritual Chain

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**Abstract:** In promoting the digital and intelligent transformation of ideological and political education, smart classrooms face the problem of declining teaching quality caused by technology. Existing research mostly focuses on technological innovation while ignoring ritual disruption in teaching. Based on the interaction ritual chain theory, this paper analyzes problems in scenarios, emotions, focuses, and symbols, and proposes improvement paths from four dimensions: teaching field, emotional energy, students' attention, and symbol system. It aims to bridge the gap between technology and values and assist the high-quality development of ideological and political education.

**Keywords:** Interaction ritual chain; Ideological and political education; Smart classrooms; Teaching quality; Improvement paths

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## 1. Introduction

With the development of digital technology, the digital and intelligent transformation of ideological and political education has become an inevitable trend. As a product of the integration of technological development and classroom teaching, smart classrooms are new-type intelligent and efficient classrooms built with emerging technologies such as artificial intelligence and big data <sup>[1]</sup>. Existing research mostly focuses on technology application but ignores its impact on the transmission of ideological and political values. Drawing on Randall Collins' interaction ritual chain theory, this paper regards ideological and political teaching as an organized interaction ritual, and analyzes the ritual disruption in smart classrooms from four dimensions: ritual space, emotional connection, symbol system, and group solidarity, so as to explore paths to improve teaching quality.

## 2. Deconstruction dimensions of the interaction ritual chain theory

Proposed by sociologist Randall Collins, the interaction ritual chain theory emphasizes that social interaction

can generate emotional energy and symbolic capital through ritualization. The so-called interaction ritual chain refers to a chain structure formed by countless interaction rituals occurring in specific “encounters”<sup>[2]</sup>. In educational scenarios, teaching interaction rituals is the core mechanism for knowledge transmission and value internalization. The interaction ritual chain is deconstructed from the following four dimensions:

### **2.1. Dual fields of ritual space**

Ritual space includes physical venues and psychological atmosphere. Successful rituals rely on group gathering, barriers to outsiders, shared focus of attention, and shared emotions<sup>[3]</sup>. Co-presence is the basic premise of ritual effects. Modern teaching space has developed into a mixed form integrating physical and virtual environments. Circular layouts and intelligent terminals break the physical boundaries of traditional teacher-student interaction and promote the transformation of teaching towards collaboration. Lefebvre holds that space is not an abstract natural substance or a static “platform” external to human activities; it arises from purposeful social practice and is a product of social relations<sup>[4]</sup>. The new-type teaching space not only enhances students’ sense of presence but also provides a practical carrier for value transmission.

### **2.2. Dynamic mechanism of emotional connection**

Emotional connection is the dynamic mechanism of interaction rituals, referring to the flow of emotional energy formed by participants through rhythm synchronization, shared focus, and emotional resonance. The core driving force of the interaction ritual chain is “emotional energy”<sup>[5]</sup>. Collins points out that interaction rituals generate group solidarity through the accumulation of emotional energy. Introduced into teaching scenarios, the emotional connection between teachers and students directly affects teaching effects. Teachers create a classroom atmosphere through embodied expressions such as eye contact and body language to stimulate students’ learning interest. Students’ positive responses in turn motivate teachers, forming a virtuous cycle.

### **2.3. Meaning medium of symbol system**

Symbols are the medium for transforming collective consciousness into individual cognition. Durkheim proposed that symbols usually carry collective emotional values to arouse the same emotional resonance among group members<sup>[6]</sup>. The teaching process is a process of transmission and internalization of symbolic meanings. Teachers transform disciplinary knowledge into an understandable symbol system, and students achieve knowledge internalization through understanding. Group symbols are generated on the basis of emotional energy in the interaction ritual chain; they are symbols combining emotional energy with physical representations and realistic carriers of emotional energy<sup>[7]</sup>. Through symbolic expressions such as specific gestures and disciplinary terms, teachers repeatedly strengthen the authority of knowledge transmission and the rationality of teaching norms.

### **2.4. Coupling the outcome of group solidarity**

As a ritual outcome, group solidarity maintains intersubjectivity in the interaction process<sup>[8]</sup>. Solidarity in the teaching field is gradually constructed through repeated interaction rituals. In this process, interaction participants form a shared focus of attention, and under the premise of strongly feeling each other’s consciousness, they continuously strengthen the rhythmic connection of words, body movements, and emotions, thereby stimulating participants to further improve their subjectivity in mutual participation<sup>[9]</sup>. Rhythm synchronization, shared focus, and clear boundaries in teacher-student interaction enable teaching rituals to produce emotional connection effects, and form a teaching community through group cooperation and role division to enhance students’ sense of group

identity.

### **3. Manifestations of ritual disruption in ideological and political smart classrooms**

Examining the problems of ideological and political smart classrooms, the following four disruption characteristics are found: temporal-spatial disembedding of teaching scenarios, asynchronous loss of emotional connection, discrete tendency of focus setting, and intergenerational estrangement in symbol construction, which constitute the contradictions that need to be resolved urgently.

#### **3.1. Temporal-spatial disembedding of teaching scenarios**

The obvious temporal-spatial separation between teachers and students in ideological and political smart classrooms directly affects teaching interaction and effects. On the one hand, the application of technology and mixed teaching models weakens the necessity of physical co-presence and changes the interaction rhythm. Online teaching often fragments discussions due to network delays and cumbersome operations, reducing the depth of ideological exchanges that ideological and political education should have. On the other hand, once the interaction between educational subjects and objects is separated from the original common space, it may lead to the so-called “disembedding” phenomenon proposed by Giddens<sup>[10]</sup>. In online teaching, although students achieve digital presence, physical absence leads to distracted attention. This separation between virtual and real spaces weakens the collective sense of immersion and the energy aggregation effect of the classroom.

#### **3.2. Asynchronous loss of emotional connection**

Technological intervention weakens the emotional connection and interaction quality between teachers and students in smart classrooms. On the one hand, the screen barrier limits teachers’ emotional expression, resulting in the loss of on-site texture of voice and expressions, reducing the effect of emotional transmission, and weakening the unique emotional penetration and value guidance of ideological and political education. On the other hand, the quality of online interaction among students declines. Discussions are difficult to achieve in-depth collisions, and students tend to superficially agree rather than communicate sincerely, with insufficient emotional investment, affecting the generation of collective wisdom and value internalization.

#### **3.3. Discrete tendency of focus setting**

The excessive use of multimedia technology is likely to cause students’ distracted attention and lack of focus, affecting the formation of interaction rituals and the effectiveness of ideological and political education. Meng et al. proposed that having a shared focus of attention is the premise and foundation for forming common meaning symbols and establishing emotional connections<sup>[11]</sup>. The lack of focus of attention is an important reason for the failure and emptiness of interaction rituals. While enriching teaching content, multimedia resources exacerbate cognitive fragmentation due to frequent interface switching, hindering in-depth thinking and knowledge construction. Formalized resource presentation further weakens the internal logic and persuasiveness of ideological and political education.

#### **3.4. Intergenerational differences in symbol construction**

There is a problem of weakening symbol systems in ideological and political smart classrooms, which is specifically manifested in the declining explanatory power of traditional discourse systems and insufficient integration of

emerging symbol systems, affecting the transmission of values and the construction of group identity. Durkheim emphasized that thoughts and emotions can only exist for a long time through symbols<sup>[12]</sup>. However, the traditional discourse system has insufficient explanatory power for emerging symbols, and students are more accustomed to expressing their views using emerging symbols, making classroom discourse lose practical support. On the other hand, the integration of emerging symbol systems in the interaction between teachers and students is insufficient. Teachers' use of youth subcultural symbols such as internet buzzwords and emoticons is awkward, and the design of smart platforms does not fully consider the complexity of value internalization, leading to symbol adaptation dilemmas and exacerbating intergenerational cognitive conflicts.

## **4. Paths to improve the teaching quality of ideological and political smart classrooms**

Smart classrooms have injected new vitality into ideological and political education. Technologies such as intelligent terminals have expanded teaching space and reshaped the teacher-student relationship. However, technological empowerment has also brought new challenges. How to use technology to break the barriers of teaching fields, stimulate emotional resonance, focus on cognitive core, and innovate symbolic expression has become the key to improving the effectiveness of ideological and political education.

### **4.1. Reconstruct multimodal teaching fields**

#### **4.1.1. Integration of physical and virtual spaces**

The construction of ideological and political smart classrooms requires the organic integration of physical spaces and virtual environments. Ideological and political education needs to give play to the advantages of technologies such as intelligent terminals and virtual reality to transform teaching content into a more interactive and immersive digital form. Teachers use VR technology to create historical scenarios, allowing students to deepen their understanding of red culture through immersive experiences. Use online platforms to integrate diverse teaching resources to help students build a systematic knowledge structure.

#### **4.1.2. Organic unity of synchronous and asynchronous interaction**

The organic combination of synchronous and asynchronous interaction is the key to building a multimodal teaching field. Interpersonal interaction in teaching plays an irreplaceable role in promoting individual development, collaborative learning, and group wisdom enhancement<sup>[13]</sup>. Synchronous interaction facilitates teachers to obtain timely feedback, while asynchronous interaction makes up for the limitation of insufficient student expression in synchronous mode. By releasing topics and tasks through online platforms, students can arrange their learning flexibly. Reasonably allocate the two interaction modes, balance teaching efficiency and depth, and promote the systematic transmission of knowledge and effective internalization of values.

## **4.2. Strengthen teachers' and students' emotional energy**

### **4.2.1. Multidimensional feedback to promote emotional resonance**

Teachers use multidimensional feedback to build a positive cycle of emotional energy and promote the formation and deepening of emotional resonance. Instant feedback is the starting point for stimulating students' emotional resonance. Teachers integrate ideological and political theory education into emotional interaction through diversified instant feedback methods, transforming abstract political identity into perceptible emotional identity. In online interaction sessions, teachers can deepen value guidance through personalized comments and expand



the temporal and spatial dimensions of emotional interaction. This emotional feedback mechanism throughout the teaching process effectively strengthens students' sense of classroom belonging, elevating ideological and political education from mere knowledge transmission to emotional communication and resonance.

#### **4.2.2. Hierarchical progression to gather emotional energy**

According to students' cognitive levels and emotional development stages, teachers adopt a hierarchical and progressive approach to gradually gather emotional energy in the classroom. Giving full play to the positive role of emotions in ideological and political courses will help improve students' cognitive levels and enhance classroom teaching effectiveness<sup>[14]</sup>. First, stimulate emotional experience by creating scenarios to guide students to generate initial emotional resonance with ideological and political knowledge. Second, promote emotional identity through case discussions. Finally, guide the transformation of emotional experience into actions through progressive practice. This hierarchical and progressive way of emotional gathering promotes the gradual sublimation of students' emotions, making ideological and political education truly touch students' hearts.

### **4.3. Guide the return of students' attention**

#### **4.3.1. Construct knowledge graphs to promote the internalization of ideological and political theories**

Systematically integrate teaching resources by building a structured knowledge graph system to improve students' cognitive focus and theoretical internalization effects. Teachers use knowledge graphs to integrate scattered teaching resources, form a clear knowledge framework, help students establish a stable cognitive focus, strengthen knowledge connections, and systematically grasp ideological and political theories. It helps students gradually realize the transformation from fragmented reception to systematic understanding, and ultimately achieve an in-depth grasp and internalization of ideological and political theories.

#### **4.3.2. Set learning tasks to regulate attention allocation**

To address the problem of distracted attention, teachers achieve precise guidance and dynamic regulation of students' attention by setting specific and measurable learning tasks. In the teaching design stage, transform abstract ideological and political value concepts into clear learning tasks to help students grasp learning goals and key points. At the same time, with the help of real-time data analysis from smart teaching platforms, teachers can dynamically optimize task settings and rhythm arrangements according to student feedback, respecting students' learning laws while ensuring the effective transmission of core ideological and political values, thereby improving teaching effectiveness.

### **4.4. Innovate the symbol system for value transmission**

#### **4.4.1. Strengthen the modern representation transformation of traditional discourse**

Ideological and political education should promote the modern transformation of the symbol system, taking symbol innovation as a breakthrough to achieve intergenerational connection and improve educational effectiveness. The appropriate use of ritual symbols can strengthen the effect of ritual education<sup>[15]</sup>. Teachers use multimedia to transform abstract theories into concrete audio-visual symbols, enhance appeal through situational narratives, and reconstruct traditional discourse based on students' characteristics to make it closer to students' lives and language styles. It effectively bridges intergenerational cognitive differences, enhances the penetration of value transmission, and promotes the deep integration of cultural inheritance and educational goals.

#### 4.4.2. Promote the positive transformation of youth subcultural resources

Relying on smart education platforms, teachers organically integrate youth subcultures into value education through dynamic monitoring and guided transformation. Establish a dynamic monitoring mechanism to grasp youth cultural trends, understand students' cultural preferences through classroom interactions, questionnaires, etc., and explore positive elements to combine with ideological and political content. It not only respects students' cultural subjectivity but also realizes the flexible transmission and intergenerational connection of mainstream values.

### Disclosure statement

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# Practice and Exploration on the Teaching Reform of Plant Protection Course in Higher Vocational Colleges

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**Abstract:** With the accelerating process of agricultural modernization, plant protection, as an important guarantee for agricultural production, has an increasingly urgent demand for professional talents. As a key base for cultivating applied agricultural technical talents, the teaching quality of plant protection courses in higher vocational colleges directly affects the effectiveness of talent training. Based on this, this paper studies the teaching reform of plant protection courses in higher vocational colleges, expounds the existing problems, analyzes the important value of the reform, and proposes corresponding reform and practice strategies. It aims to improve the teaching effect of plant protection courses and provide talent support for agricultural development.

**Keywords:** Higher vocational colleges; Plant protection course; Teaching reform; Practice strategies

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## 1. Introduction

Plant protection is an important branch of agricultural science, undertaking the important mission of ensuring the yield and quality of crops and safeguarding the safety of the ecological environment. Under the background of the in-depth implementation of the rural revitalization strategy and the continuous adjustment and optimization of the agricultural industrial structure, agricultural production is increasingly dependent on plant protection technology, and higher requirements are put forward for the skill level and comprehensive quality of plant protection professionals<sup>[1]</sup>. Higher vocational colleges aim to cultivate high-quality technical and skilled talents, and the plant protection courses they offer play a pivotal role in the talent training system of agricultural majors. Therefore, in-depth practice and exploration of the teaching reform of plant protection courses in higher vocational colleges are of great value.

## **2. Existing problems in the teaching of plant protection courses in higher vocational colleges**

### **2.1. Insufficient update of teaching content**

The plant protection discipline is developing rapidly. With the continuous progress of science and technology, new types of diseases and insect pests, new prevention and control technologies, new pesticide products, and new plant protection concepts are constantly emerging. However, the teaching content of plant protection courses in some higher vocational colleges is updated slowly and lags behind industry development<sup>[2]</sup>. In terms of textbook selection, some colleges and universities still use textbooks published many years ago. Some content in the textbooks is outdated and cannot reflect the latest research results and technical trends in the field of plant protection. There is a lack of introduction to the application of plant protection technologies under modern agricultural production models, such as plant protection technologies in protected agriculture, organic agriculture, and smart agriculture. These problems lead to the disconnection between the knowledge learned by students and the actual needs of the industry, making it difficult for them to quickly adapt to the requirements of jobs after graduation.

### **2.2. Outdated teaching model**

At present, the plant protection courses in many higher vocational colleges still mainly adopt the traditional one-way indoctrination teaching model. In this teaching model, teachers occupy a dominant position in the classroom, and students are in a passive state of accepting knowledge, lacking opportunities for active thinking and active participation<sup>[3]</sup>. Classroom teaching is often limited to the explanation of textbook content. Teachers impart theoretical knowledge word by word in accordance with the chapter order, rarely interact with students, and it is difficult to adjust the teaching rhythm and content in a timely manner according to students' learning situation and interests. In addition, some teachers do not fully apply modern educational technology, the classroom teaching methods are single, and there is a lack of effective use of modern teaching tools such as multimedia courseware and network resources, which further reduces the attractiveness and appeal of classroom teaching.

### **2.3. Lack of practical links**

Plant protection is a highly practical discipline, and practical teaching is an important link in cultivating students' professional skills and comprehensive quality. However, the practical links of plant protection courses in many higher vocational colleges currently have many deficiencies, which cannot meet the needs of talent training. The content of practical teaching is single and the form is rigid<sup>[4]</sup>. Practical teaching is often limited to simple operations in on-campus laboratories, such as the production and identification of disease and insect pest specimens, and the preparation of pesticides. There is a lack of comprehensive and innovative practical projects closely combined with actual field production.

## **3. Important value of the teaching reform of plant protection courses in higher vocational colleges**

### **3.1. Conducive to cultivating high-quality applied talents meeting industry needs**

At present, the demand for plant protection professionals in the agricultural industry has shifted from traditional technical operation-oriented to high-quality applied-oriented. It requires talents to not only have solid theoretical knowledge but also strong practical ability, innovative ability, and comprehensive quality. The teaching reform of plant protection courses in higher vocational colleges, through measures such as optimizing the teaching model,

updating teaching content, and strengthening practical links, can make teaching closer to the actual needs of the industry. The cultivated students can quickly adapt to the jobs in the front line of agricultural production <sup>[5]</sup>. For example, through case teaching, project teaching, and other methods, students can master knowledge and skills in the process of solving practical problems; by introducing cutting-edge technologies such as green plant protection and smart plant protection, students' knowledge and vision can be broadened. These reform measures can effectively improve students' professional ability and comprehensive quality, making them high-quality applied talents meeting the needs of industry development, and injecting new vitality into the development of the agricultural industry.

### **3.2. Conducive to improving the college-running quality and competitiveness of higher vocational colleges**

Curriculum teaching is the core link of talent training in higher vocational colleges, and the quality of curriculum teaching is directly related to the running quality and competitiveness of the colleges. As one of the core courses of agricultural majors, the effect of the teaching reform of plant protection courses has an important impact on the development of agricultural majors in higher vocational colleges. Through teaching reform, the teaching level and quality of plant protection courses can be continuously improved, and the attractiveness and influence of the major can be enhanced <sup>[6]</sup>. At the same time, the experience and practices accumulated in the process of teaching reform can also provide a reference for the teaching reform of other courses, promoting the improvement of the overall teaching quality of higher vocational colleges. In the context of the rapid development of vocational education, only by continuously deepening teaching reform and improving college-running quality can higher vocational colleges stand out in the fierce competition and win social recognition and praise <sup>[7]</sup>.

### **3.3. Conducive to promoting sustainable agricultural development and the implementation of the rural revitalization strategy**

Grasping agricultural development must attach importance to plant protection work, which is related to the yield and quality of agricultural products, food safety, and environmental safety. With the comprehensive implementation of the rural revitalization strategy, green development and high-quality development will become new trends, which also put forward new requirements for plant protection. The reform of plant protection professional education in higher vocational colleges integrates green plant protection concepts and plant protection technologies into teaching content, which can cultivate students' ecological and environmental protection awareness and strengthen their sustainable development concepts. In their future jobs, students will advocate and apply green plant protection technologies, realize the reduction of pesticide use, prevent pollution from the source, and ensure the health of the natural environment <sup>[8]</sup>. In addition, the senior plant protection talents cultivated by these higher vocational colleges can provide scientific and technological support for agricultural production, help farmers solve the problems of diseases and insect pests, increase the yield and quality of crops, improve farmers' income, and provide strong talent and technical services for the realization of the rural revitalization plan.

## **4. Practical strategies for the teaching reform of plant protection courses in higher vocational colleges**

### **4.1. Timely update of teaching content and introduction of cutting-edge materials**

Teaching content is an important basis for teaching activities. Teachers should timely update teaching content



and introduce cutting-edge materials into teaching to improve the effectiveness and pertinence of teaching. First, optimize textbook content. Teachers can compile college-based textbooks or handouts according to the actual situation of the college and local agricultural characteristics. The college-based textbooks can introduce some common local types of diseases and insect pests and characteristic crop plant protection technologies, narrowing the distance between the course and students; the handouts should focus on the combination of theory and practice, adding some content such as case analysis and practical operation guidance to make the handouts more operable<sup>[9]</sup>.

Second, introduce cutting-edge knowledge and technologies. For example, teachers can add content such as alien invasive species prevention and control technologies and smart plant protection technologies, introduce drone plant protection, Internet of Things detection of diseases and insect pests, etc. to students, invite some industry experts to give on-site explanations to students, and display cutting-edge industry technologies, so as to broaden students' knowledge and vision. Teachers should also use some network resources to collect the latest industry materials and incorporate them into teaching promptly to improve the advanced nature of teaching content<sup>[10]</sup>. Third, adjust teaching content in combination with regional agricultural characteristics. Higher vocational colleges mainly cultivate talents for regional development, which requires the teaching of plant protection courses to be adjusted to regional agricultural characteristics. Different regions have different climatic conditions and the occurrence of diseases and insect pests. Teachers can adjust the teaching content according to the local crop situation. For example, Yibin, where our college is located, is rich in characteristic crops such as Wuliangye special grain, citrus, and plums. Teachers can focus on explaining the common anthracnose and aphid prevention and control technologies of Yibin sorghum, introduce the comprehensive prevention and control measures of citrus canker and plum red spot disease, etc., and display the planting models of Yibin mountainous agriculture and characteristic orchards, so that students can better meet the needs of Yibin's agricultural production after graduation<sup>[11]</sup> and provide support for local agricultural development.

## **4.2. Set up diversified teaching models to improve teaching effect**

In the curriculum teaching reform, teachers should pay attention to setting up diversified teaching methods to effectively improve teaching effect. First, carry out online-offline mixed teaching. In the online link, teachers can use platforms such as MOOC or Xuexitong to carry out teaching, provide students with rich learning resources, so that they can arrange time according to their own learning rhythm, conduct online learning independently, and complete the tasks assigned by teachers. In the offline link, teachers can focus on interactive communication and practical guidance, focus on explaining the problems arising online, and answering students' doubts<sup>[12]</sup>. For example, when explaining the content of "comprehensive prevention and control of crop diseases and insect pests", teachers can first upload some micro-course videos and disease and insect pest case materials online to let students understand the course knowledge in advance, and organize students to analyze cases, put forward prevention and control schemes, and carry out simulated prevention and control operations in offline classes to master the course knowledge.

Second, carry out case teaching. Teachers can obtain cases of real events from the front line of agricultural production, such as the outbreak case of rice planthoppers and the comprehensive prevention and control case of orchard canker, and let students analyze the cases, find out the key problems, and put forward relevant solutions. Teachers compare and evaluate students' schemes. The selection of cases should pay attention to typicality and pertinence, and be able to reflect the hot issues and actual needs in the current field of plant protection, so as to be more in line with teaching<sup>[13]</sup>.

Third, carry out curriculum ideological and political education. Teachers should organically integrate curriculum, ideological and political elements into the teaching links of the plant protection major, and cultivate students' sense of work responsibility, social responsibility, and patriotic feelings. Explore ideological and political elements, such as examples of outstanding individuals in the plant protection profession and examples of scientific and technological achievements from teaching materials. For example, introduce the contributions made by excellent Chinese plant protection experts to the research on disease and insect pest prevention and control, and cultivate their national pride and creative spirit; explain the concept of green plant protection, and enhance their awareness of ecological protection and sustainable development <sup>[14]</sup>. Through the integration of curriculum, ideological and political education, the organic unity of knowledge impartation, ability training, and value guidance can be realized, and students' comprehensive quality can be comprehensively improved.

#### **4.3. Strengthen practical teaching links to exercise comprehensive skills**

Practical teaching is an important way to exercise students' practical skills. Teachers should strengthen the adjustment and reform of practical teaching links to effectively exercise students' comprehensive skills. First, promote the combination of classroom teaching and field practice. Higher vocational colleges should increase the proportion of practical teaching content and apply it to classroom teaching, and combine it with rural practice. Insert rural practice content into the theoretical teaching link, guide students to go to the front line of rural areas to observe the occurrence of diseases and insect pests and the characterization mode of prevention and control, so as to deepen the impression of theoretical teaching content. For example, when teaching the knowledge topic of "identifying and diagnosing diseases and insect pests", encourage students to conduct on-site investigations in rural areas, sample and identify, and carry out diagnostic training; when teaching knowledge topics such as "pesticide use technology", lead students to carry out practical activities such as pesticide preparation and sprayer use in farmland.

Second, build practice bases through college-enterprise cooperation. Higher vocational colleges should strengthen the stable construction of off-campus internship bases in cooperation with agricultural enterprises, cooperatives, plant protection departments, and other departments. Both parties jointly formulate practical teaching plans, and the company selects technical personnel as internship instructors to guide students' internship and learning together with higher vocational college teachers. The higher vocational college can also use the company's resources to expand college-enterprise production, education, and research cooperation projects. Both students and teachers can participate in the development of scientific research projects to strengthen students' innovative ability and scientific research ability. It can cooperate with pesticide production enterprises to enable students to participate in the verification of new pesticide products; cooperate with large-scale growers to enable students to participate in the whole process of crop disease and insect pest prevention and control production <sup>[15]</sup>.

Third, strengthen the construction of practical teaching faculty. Higher vocational colleges should build a "double-qualified" practical teaching faculty with solid theoretical knowledge and rich practical experience. On the one hand, encourage teachers to carry out practical training in the front line of agricultural production, take on post-internships in enterprises, and accumulate practical experience; on the other hand, introduce technical backbones and industry experts from enterprises as part-time teachers to enrich the practical teaching faculty. At the same time, higher vocational colleges regularly organize practical teaching faculty training to improve teachers' practical teaching level and guidance ability. By strengthening the construction of practical teaching faculty, it can provide a strong faculty guarantee for practical teaching and ensure that students can receive professional and effective guidance in practical learning.

## 5. Conclusion

In summary, the teaching reform of plant protection courses in higher vocational colleges is a systematic project that requires in-depth exploration and practice from multiple aspects, such as teaching models, teaching content, and practical links. In the actual teaching process, teachers should set up diversified teaching models, timely update teaching content, and strengthen practical teaching links to effectively exercise students' comprehensive abilities and improve the course teaching effect. In the subsequent teaching reform, teachers should always aim at cultivating high-quality applied talents meeting industry needs, combine the development trend of the agricultural industry and regional agricultural characteristics, continuously optimize the teaching system, innovate teaching methods, so that the teaching quality of plant protection courses can be continuously improved, and contribute to the development of vocational education.

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# Reform and Exploration of Organic Chemistry Experiment Teaching Under the Background of Curriculum Ideological and Political Education: Taking “Extraction of Caffeine from Tea” as an Example

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**Abstract:** Guided by the spirit of the National Conference on Ideological and Political Work in Colleges and Universities, this paper takes “Extraction of Caffeine from Tea” as an example, puts forward the necessity of carrying out curriculum ideological and political education in organic chemistry experiments, explores the approaches and practices of integrating curriculum ideological and political education into organic chemistry experiment teaching, and analyzes and reflects on the teaching effects. It provides a direction for carrying out experimental ideological and political education in other courses in the future.

**Keywords:** Curriculum, ideological and political education; Organic chemistry experiments; Teaching reform

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## 1. Introduction

It is emphasized that “The foundation of education lies in fostering virtue.” As the main position and channel for ideological and political work in colleges and universities, colleges and universities should promote the same direction of various courses and ideological and political theory courses, deeply explore ideological and political elements in courses, imperceptibly integrate educational elements such as ideology, politics, morality and mental health into classroom teaching, and strive to cultivate new-era youth with ideals, abilities and responsibilities<sup>[1-3]</sup>.

Organic Chemistry Experiment is a compulsory course for chemistry and biology majors at our university. Cooperating with organic chemistry theory courses, it enables students to systematically master basic operational skills of organic chemistry experiments, have the ability to correctly carry out synthesis, separation and identification of prepared products; learn to standardize the use of common instruments and equipment; improve the ability to write standardized experimental reports and consult literature, and cultivate good experimental methods and habits as well as a realistic and rigorous scientific attitude, laying a solid theoretical foundation for



subsequent course learning and future work.

## **2. Necessity of integrating curriculum, ideological and political education into organic chemistry experiment teaching**

As a basic course for chemical engineering majors, Organic Chemistry Experiment is an important part of the organic chemistry teaching system and an independently set experimental course. The course focuses on the demonstration of basic operations and the explanation of experimental principles, and carries out systematic training around the basic knowledge, core operations, and basic skills of organic chemistry experiments, aiming to standardize students' organic chemistry experimental operation skills. The content includes the selection, installation, and disassembly of glass instruments, and the principles and operational skills of experimental technologies such as reflux, distillation, fractional distillation, steam distillation, recrystallization, extraction and suction filtration. Carrying out experimental teaching can reduce the difficulty of understanding basic organic chemistry knowledge; deepen students' memory of laboratory safety knowledge, strengthen their cognition of organic chemistry experimental methods and basic operations; and also enable them to form a rigorous and serious experimental attitude and literacy, promoting the development of students' ability to analyze and solve problems and practical operation ability.

In organic chemistry experiment teaching, students need to understand various safety knowledge. Solvents and organic reagents are widely used, which are often toxic, flammable, and explosive. For example, toxic reagents include nitrobenzene, cyanides, organic halides, organic phosphides, etc.; flammable solvents include ether, ethanol, acetone, benzene, petroleum ether, etc.; explosive drugs or gases include picric acid, hydrogen, acetylene, etc.; corrosive drugs include concentrated hydrochloric acid, caustic soda, caustic potash, bromine, etc. Improper operation can easily lead to accidents such as poisoning, fire and burns. At the same time, the instruments and raw materials of organic experiments are glass, and careless handling can lead to instrument damage and personal cuts. Therefore, in carrying out organic chemistry experiment teaching, a strong sense of safety must be established. Accidents are often caused by carelessness, improper operation procedures, unfamiliarity with instruments and drugs, etc. This requires cultivating students' safety awareness in teaching, making students concentrate, abide by operating specifications, adhere to their posts, and promote them to become talents with a craftsmanship spirit <sup>[4]</sup>. In the experimental link, students need to carefully observe experimental phenomena, process experimental data rigorously, continuously reflect, find abnormal experimental situations in a timely manner, and conduct in-depth research on the causes of the phenomena.

Experimental records are important data to support scientific research, and the quality of experimental records determines the ability to accurately analyze experimental results. Therefore, we must handle the data and phenomena generated in experiments with a scientific and rigorous attitude, especially the following contents:

- (1) The amount, order and color of raw materials added.
- (2) With the increase of temperature, the color change of the reaction solution, whether there are precipitation and gas.
- (3) The quantity, color, melting point, boiling point, refractive index and other data of the product should be recorded in a timely and true manner.

When recording relevant phenomena, it must correspond to the experimental operation. This requires students to have certain abilities to discover, analyze and solve problems, and focus on cultivating students' sense of responsibility and mission to climb the peak of science and explore the unknown. In addition, according to the

synthesis principle of organic compounds, laboratory equipment can be used for the artificial synthesis of organic drugs to better help people maintain health. However, the use of organic chemistry knowledge to carry out illegal and criminal activities will be subject to legal sanctions. Therefore, it is very important to integrate ideological and political education into organic chemistry experiment courses, and we must focus on cultivating talents with correct values.

### **3. Approaches and practices of integrating curriculum, ideological and political education into organic chemistry experiment teaching**

#### **3.1. Enhancing cultural confidence and cultivating family and country feelings**

Some content in experimental teaching can be introduced from historical records to stimulate students' cultural confidence. For example, in the experiment of "Extracting Caffeine from Tea", the experimental material used is tea. China has a long history of tea culture. In carrying out this experimental teaching, we can extend from tea to China's traditional tea culture and introduce Chinese history, such as the Ancient Tea Horse Road, to students. The Ancient Tea Horse Road is a witness to China's unification and a symbol of national unity. China's tea culture is extensive and profound, and tea culture is China's traditional culture. When receiving guests, drinking tea in hot weather can eliminate fatigue and bring comfort and happiness to the body and mind. In the process of planting, picking, and making tea, the noble qualities of diligence, courage, and enthusiasm of the Chinese people are worth learning from. Through learning tea culture, students can learn how to behave and carry forward the traditional virtues of diligence and self-confidence of the Chinese nation. Guide students to re-examine excellent traditional Chinese culture from the perspective of learning chemical professional knowledge, and consciously edify their minds with excellent traditional and advanced Chinese culture<sup>[5]</sup>.

#### **3.2. Integrating safety education and establishing green environmental protection awareness**

As we all know, most of the reagents required for "Organic Chemistry Experiments" are volatile, flammable, explosive and other chemicals. The experimental process is characterized by the generation of polluting gases and the difficult treatment of waste liquids. Therefore, there are potential safety hazards such as explosions, fires, and burns in experiments. The teaching of "Organic Chemistry Experiments" should not only cultivate students' experimental operation skills and ability to analyze and solve problems, but also make them understand the characteristics of their major, pay attention to the relationship between disciplines and the environment, establish firm green environmental protection and safety concepts, and enhance social responsibility.

Emphasize the method of taking drugs in the experiment. For example, the volatile solvent ethanol in this experiment should be taken and used immediately. The condensed water only needs to play a condensation role to avoid waste of water resources; substances harmful to the environment and difficult to volatilize should be used and recycled, standardized to avoid environmental pollution. The above measures help students form good experimental habits and strengthen their awareness of resource conservation and environmental protection<sup>[6]</sup>.

#### **3.3. Stimulating students' learning interest and cultivating patriotic feelings**

Chemical synthesis methods can carry out source synthesis or modification of natural drugs (traditional Chinese medicine), making up for the shortcomings of low yield and high toxicity in the extraction of natural drugs. The achievements we obtain through experiments are not only a substance, but also promote the transformation of

scientific thinking and lifestyle. This transformation is not only conducive to reducing the pain of patients, but also helps to improve the future life happiness index of students. Based on this, the teaching of organic chemistry experiments is no longer limited to the understanding of principles and the teaching of skills, but also extends to the spiritual field, teaching students how to transform principles into physical objects and apply them to production and life, thereby enhancing their professional pride and sense of responsibility<sup>[7,8]</sup>.

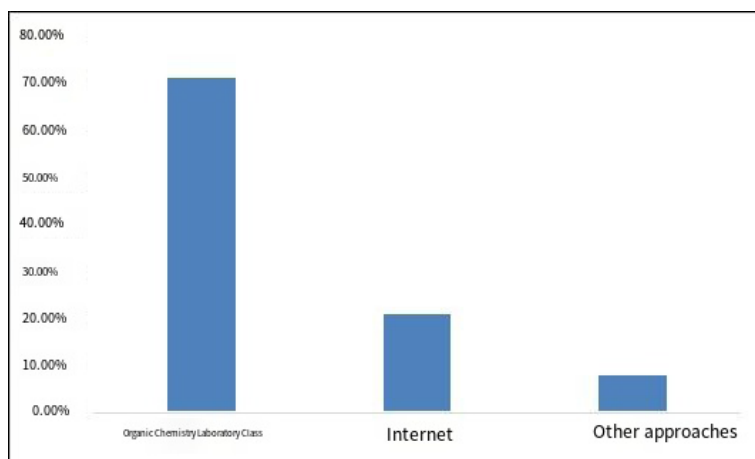
From the extraction principle of like dissolves like and the selection of solvents to scientific spirit, structure determines nature and character determines destiny; Tu Youyou's use of ether extraction method to extract artemisinin is a kind of extraction, which implies that we should aim high, climb the high peak of science and technology, build a community with a shared future for mankind, and strive for a better tomorrow for mankind. From steam distillation to the acquisition of natural spices by early humans, from dibenzylideneacetone to the industrial synthesis of chemical spices, and then to the extraction of alkaloids, to the early production of caffeine in China, we introduce the history of chemical development and the history of China's chemical industry development, telling the hardships of New China's industrial and technological development. It is the spirit of self-improvement in the blood of the Chinese nation that has made the vigorous development of our national rejuvenation today, further strengthening our cultural confidence and perseverance, and cultivating students' patriotic feelings<sup>[9,10]</sup>.

### **3.4. Strengthening integrity education and cultivating cooperative innovation awareness**

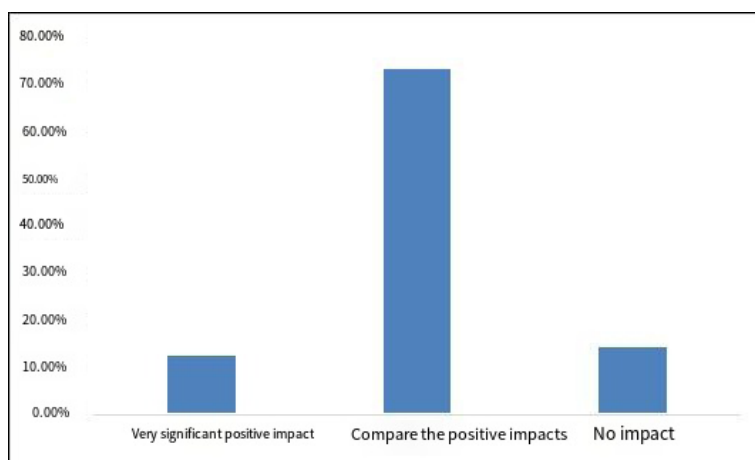
After completing each experimental project, students are required to carefully write experimental reports. The recording of experimental phenomena and data and the writing of experimental reports should be realistic and fabrication is prohibited. Students should respect original experimental data, record experimental data clearly and standardizedly, and strictly prohibit plagiarism or modification of experimental data to cultivate students' sense of integrity. Although the recording of experimental data, the processing of experimental data, and the writing of experimental reports are cumbersome, they can cultivate students' carefulness and patience. In the teaching of comprehensive and designed experiments, guide students to put forward problems, explore independently, discuss and communicate in groups, and realize the multiple functions of knowledge impartment, ability training, and value guidance. Details determine success or failure. Each member of the team divides the work reasonably, cooperates closely to complete the corresponding work, and the experimental results of each member will affect the results of the entire team. In the process of group activities, each member experiences the process of discovery, questioning, exploration and gradual innovation, cultivating students' cooperative innovation spirit to discover and solve problems when facing difficulties<sup>[11,12]</sup>.

## **4. Analysis and reflection on teaching effects**

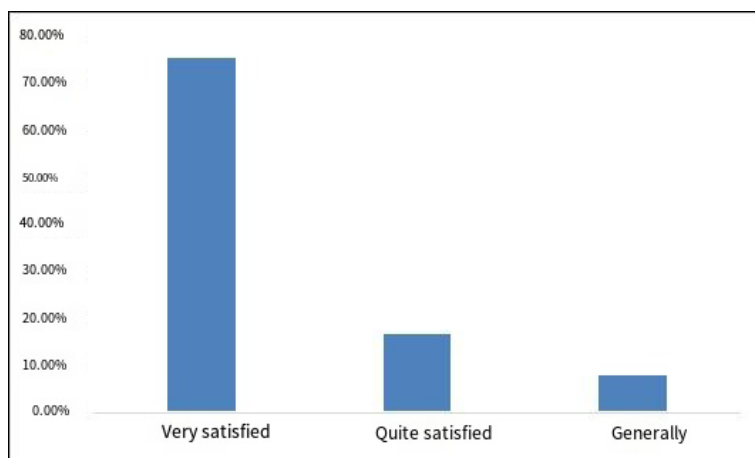
In the teaching of organic compound properties experiments, by combining experimental content, digging deep into ideological and political elements, integrating ideological and political education in the experimental process, and conducting a questionnaire survey on teaching effects through Wenjuanxing, the questionnaire investigates the ways and methods for students to learn ideological and political knowledge points in the content related to organic compound properties experiments, as well as the acceptance and satisfaction of integrating ideological and political education into chemical experiments (as shown in **Figures 1–3**).



**Figure 1.** Survey results on the ways students obtain ideological and political education knowledge related to organic compound properties.



**Figure 2.** Survey results on the impact of integrating ideological and political education into organic chemistry experiment teaching on students' learning of organic chemistry courses.



**Figure 3.** Survey results on students' satisfaction with integrating ideological and political education into organic chemistry experiment classes.

This survey targets students majoring in Biotechnology, Bioengineering, Applied Chemistry, and Chemical Engineering of the 2023 grade in our university, and a total of 239 questionnaires were collected. The survey results show that: regarding the ways for students to obtain ideological and political education knowledge related to organic compound properties, 71.13% come from organic chemistry experiment classes, 20.92% through the Internet, and 7.95% through other ways. The questionnaire results indicate that integrating ideological and political elements into experimental classroom teaching has a certain effect on students' ideological and political education. Students feel the charm of organic chemistry in the process of hands-on experiments, which has a certain positive impact on the formation of students' outlook on life and values. Regarding the impact of integrating ideological and political education into organic chemistry experiment teaching on students' learning of organic chemistry courses: 12.55% of the students believe it has a very significant positive impact, 73.22% believe it has a relatively significant positive impact, and only 14.23% believe it has no impact. Overall, the integration of ideological and political education into organic chemistry experiment teaching has a positive impact on students' learning of organic chemistry courses, which provides operable approaches and methods for our experimental instructors to integrate ideological and political education into future experimental classroom teaching. In the survey on students' satisfaction with integrating ideological and political education into organic chemistry experiment classes, 75.31% of the students are very satisfied with the integration of ideological and political education into organic chemistry experiment classroom teaching, 16.74% are relatively satisfied, and only 7.95% are generally satisfied. It can be seen that students recognize the teaching form of integrating ideological and political education into organic chemistry experiment classroom teaching, which provides a direction for us to carry out experimental ideological and political education in other courses in the future<sup>[13,15]</sup>.

## 5. Conclusion

Curriculum ideological and political education is not a new course. To achieve good results in integrating ideological and political education into experimental teaching, teachers must first improve their ideological understanding and not ignore or give up because of the short class time. But at the same time, it should be remembered that experimental courses are operation-oriented courses. Unlike theoretical classrooms, ideological and political penetration cannot be carried out in many cases. We must combine experimental content to achieve an appropriate degree, not only ensuring students' hands-on operation time, but also improving students' ideological quality, realizing the goal of ideological and value guidance, achieving the purpose of fostering virtue through education, and completing the task of talent training.

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# Practice and Exploration of Higher Vocational Public English Course Reform in Higher Vocational Education under the Background of “Post, Course, Competition and Certificate”

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**Abstract:** With the deepening of industry-education integration, the integration of “post, course, competition, and certificate” has become the core orientation of higher vocational education course reform. Higher vocational public English courses face problems such as disconnection between “course and post”, separation of “competition and teaching”, imbalance of “certificate and teaching”, and single evaluation. This paper explores the paths and methods of course reform from five dimensions: reconstructing curriculum standards, integrating teaching content, transforming resources, integrating teaching processes, and building a diversified evaluation system. It aims to realize the in-depth connection between English teaching and post needs, skill competitions, and provide a reference for the higher vocational public English courses reform.

**Keywords:** Higher vocational public English; Integration of post, course, competition, and certificate; Course reform

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## 1. Introduction

Deepening industry-education integration is of great significance for comprehensively improving teaching quality, expanding employment and entrepreneurship, and promoting economic transformation and upgrading under the new situation<sup>[1]</sup>. The “National Vocational Education Reform Implementation Plan” proposes to “improve the comprehensive talent training mechanism of ‘post, course, competition and certificate’”. The “Higher Vocational Education Junior College English Curriculum Standards (2021 Edition)” emphasizes that curriculum content should be connected with professional practice and workplace needs, creating teaching scenario tasks similar to those in industries and enterprises. English teaching reform aims to combine industrial needs with educational content to cultivate students’ practical application abilities<sup>[2]</sup>. By integrating actual work needs, curriculum content, competition activities and professional certificates, “post, course, competition and certificate” improves students’ English learning motivation and practical application abilities, meeting the needs of their future career development<sup>[3]</sup>. Implementing the integrated teaching model of “post, course, competition, and certificate” in public English courses is an inevitable choice to keep up with the times<sup>[4]</sup>.

## **2. Current situation and prominent problems of higher vocational public English teaching**

### **2.1. Disconnection between “course and post”**

Most higher vocational colleges use a unified curriculum standard, teaching plan, textbook and evaluation system for public English courses, lacking professional pertinence and uniqueness. It is difficult to connect with the post needs, which affects the quality of talent training<sup>[5]</sup>. Teaching often focuses on the imparting of linguistic knowledge<sup>[6]</sup>, ignoring the cultivation of workplace English skills, and the urgent need to supplement industry-specific English knowledge<sup>[7]</sup>. For example, the product promotion and interpersonal communication skills required by e-commerce students are not systematically trained in the courses, resulting in a disconnection between teaching and actual post needs.

### **2.2. Separation of “competition and teaching”**

Skill competitions are important platforms to improve students' practical abilities and test teaching quality. Higher vocational public English competitions, such as the “Foreign Language Teaching and Research Press·Guocai Cup” and “Understanding Contemporary China” National College Students' Foreign Language Ability Competition, have scoring standards and ability requirements that are highly consistent with workplace English communication abilities. Most colleges regard skill competitions as “elite activities for a few people”, failing to integrate competition content, scoring standards, and training methods into daily teaching; competition results are not transformed into teaching resources, and the coverage of competition benefits is narrow, failing to achieve the educational goal of “promoting learning and teaching through competitions”.

### **2.3. Imbalance of “certifications and teaching”**

Most higher vocational colleges take the final exam as the main evaluation basis for public English teaching. Some teachers fall into the misunderstanding of “examination-oriented teaching”, ignoring the cultivation of English application abilities in professional scenarios. Students can pass exams, but cannot apply English. They are often at a loss when facing practical tasks such as product introduction, customer communication and complaint handling.

### **2.4. Single evaluation**

The evaluation method of higher vocational English teaching is relatively single<sup>[8]</sup>. The evaluation subject of traditional higher vocational public English teaching is only teachers, and the evaluation content focuses on the memory and reproduction of linguistic knowledge, ignoring the assessment of students' post-application abilities, cross-cultural communication abilities and professional literacy, which is contrary to the educational concept of integrating “post, course, competition and certificate”.

## **3. Reform paths of higher vocational public english courses under the integration of “post, course, competition and certificate”**

### **3.1. Reconstruct professionally targeted curriculum standards**

Curriculum standards are the core basis for the integration of “post, course, competition and certificate”. It is necessary to systematically integrate various standards and reconstruct the curriculum standard system in combination with post needs.

- (1) Establish a curriculum standard development team composed of “English teachers + enterprise teachers + competition judges + certificate assessors”, investigate the employment posts corresponding to the

major (such as foreign-related tour guides), sort out the core English skills (such as English tour guides' welcome speeches) and professional literacy (such as communication etiquette, teamwork and sense of responsibility) required by the posts, and form a list of post English ability requirements.

- (2) Integrate national vocational education standards, post standards, competition standards (such as the requirements for language expression, logical thinking, video creativity, material selection, video editing and shooting skills in the "Foreign Language Teaching and Research Press·Guocai Cup" and "Understanding Contemporary China" National College Students' Foreign Language Ability Competition) and English tour guide certificate examination standards, extract common and individual needs, and transform them into the knowledge, skill and literacy goals of the course.
- (3) Formulate differentiated curriculum standards for major categories. For example, the e-commerce major focuses on skill goals such as product promotion and platform communication; the tourism management major highlights literacy requirements such as English expression of tour guides' welcome speeches, foreign-related reception etiquette and cross-cultural communication, ensuring that the curriculum standards are highly consistent with post needs, competition requirements and certificate assessments.

### 3.2. Construct a modular teaching content system

Teaching content is the carrier for the integration of "post, course, competition and certificate". Centered on post ability needs, break the boundaries of textbook chapters and construct a modular and project-based teaching content system.

#### 3.2.1. Design modules based on post work processes

Taking the post work process as the logical clue, divide the teaching content into modules, each corresponding to specific vocational ability requirements. Based on the e-commerce work process of "pre-sale - in-sale - after-sale", the author constructs three modules, six projects and several sub-tasks for the practical teaching of e-commerce majors (**Table 1**), exploring the integration of "post, course, competition and certificate".

**Table 1.** Modular design of practical teaching for e-commerce majors

Modules	Projects	Core tasks	Recommended class hours	Corresponding ability goals
Pre-sale	Brand Establishment and Marketing	Brand positioning, naming, marketing plan design and drill	2	English expression for brand promotion, business copywriting ability
	Product Selection and Introduction	Product understanding, selection, interpretation, presentation and drill	2	English expression for product promotion, interpersonal communication ability
In-sale	Order Management	Inquiry response, price negotiation, ordering, payment, order follow-up and drill	2	English skills for business negotiation, interpersonal communication ability
	Logistics and Warehousing	Warehousing, packaging, logistics selection, logistics tracking and drill	2	Logistics-related English expression, practical operation ability
After-sale	After-sales Service	Dispute handling, return and exchange, claim settlement, customer feedback and drill	2	English skills for complaint handling, customer service literacy
Comprehensive Application	Simulation Drill	Simulation of complete e-commerce business processes	2	Comprehensive vocational English application ability

### 3.2.2. Integrate competition and certificate assessment content

Incorporate competition points and professional certificate examination points into task design. Taking the project “Product Selection and Introduction” as an example, combined with the examination points such as “understanding products, selecting products and describing products” in the “1+X Cross-border E-commerce B2B Data Operation Vocational Grade Certificate”, and referring to the scoring standards of writing and speech competitions, select Xiangyunsha cheongsams from Hubei intangible cultural heritage Xiangyunsha base as the training carrier, and design six sub-tasks (**Table 2**): “Understanding Xiangyunsha Cheongsams, Selecting Xiangyunsha Cheongsams, Appreciating Xiangyunsha Cheongsams, Describing Xiangyunsha Cheongsams, Discussing Xiangyunsha Cheongsams and Displaying Xiangyunsha Cheongsams”. Each sub-task corresponds to post-skill requirements, and integrates the language expression, logical thinking requirements of competitions and knowledge points of certificate examinations, enabling students to improve their competition ability and certificate examination level while completing post tasks.

**Table 2.** Integration design of “post, course, competition and certificate” for the project “product selection and introduction”

Sub-tasks	Corresponding Post Skills	Certificate Examination Points	Competition Points
Understanding Xiangyunsha Cheongsams	Product research and information sorting	Understanding basic product information	Material accumulation for prepared speeches
Selecting Xiangyunsha Cheongsams	Target market product selection	Product selection and positioning	Applied reading ability
Appreciating Xiangyunsha Cheongsams	Product quality and characteristic analysis	Product interpretation ability	Logical thinking in oral expression
Describing Xiangyunsha Cheongsams	Product selling point elaboration	Standardized product description	Completeness of speech content
Discussing Xiangyunsha Cheongsams	Customer consultation answering	Communication skills	Impromptu response ability
Displaying Xiangyunsha Cheongsams	Product display plan design	Product display expression	Business copywriting in writing competitions

### 3.2.3. Supplement real workplace case resources

The content of higher vocational public English teaching needs to focus on forward-looking and practicality<sup>[9]</sup>. Organize teachers to go deep into the front line of enterprises, collect materials such as product specifications and customer communication cases, transform them into teaching cases, and enhance the authenticity and practicality of teaching content. Students learn English in real workplace scenarios and improve their language application abilities.

## 3.3. Construct a diversified teaching resource system

The effective implementation of the integration of “post, course, competition and certificate” is inseparable from the support of high-quality teaching resources. Promote the transformation of enterprise resources and competition resources into teaching resources, and construct a diversified teaching resource system.

### 3.3.1. Transform enterprise resources into teaching resources

Strengthen the construction of teaching resource libraries<sup>[10]</sup>. Establish school-enterprise cooperation bases,



organize teachers to participate in enterprise practice, collect workplace English materials (such as product promotion videos), and process them into teaching cases, practical training tasks or assessment question banks. Invite enterprise teachers to participate in the development of teaching resources to ensure the professionalism and practicality of resources.

### **3.3.2. Transform competition resources into curriculum resources**

The integration of competition content is difficult for students with weak foundations<sup>[11]</sup>. Competition resources can be transformed into teaching resources accessible to all students, breaking the “elite” limitation of competitions. Collect competition real questions, training materials and excellent award-winning works, establish a competition resource library, and integrate them into daily teaching. For example, use real questions from speech competitions as classroom oral training tasks; take excellent model essays from writing competitions as models for students to imitate; use award-winning works from short video competitions as examples for students to make short video works. Systematically teach competition preparation methods in classroom teaching to realize “promoting learning and teaching through competitions”.

## **3.4. Collaboratively promote teaching and practice**

The core of the integration of “post, course, competition and certificate” lies in process integration. Organically combine work processes, competition training processes, certificate examination processes and teaching processes, and construct an integrated teaching model of “teaching, learning, doing, competing and assessing”.

### **3.4.1. Workplace-oriented teaching processes**

Design teaching implementation processes based on post-work processes, adopt project-based teaching methods, situational teaching methods and task-driven teaching methods, and create workplace scenarios. For example, in the teaching of the “Order Management” module, divide students into “sellers” and “buyers”, and simulate business negotiation processes such as inquiry, offer, counter-offer, and acceptance on e-commerce platforms. Students are familiar with post processes and improve their workplace English application abilities through role-playing.

### **3.4.2. Regular competition training processes**

Integrate competition training into daily teaching. After the teaching of each module, organize small-scale skill competitions and evaluate them using the scoring standards of skill competitions. Students improve their abilities in regular competitions. For example, after the teaching of the “Product Selection and Introduction” module, hold a class product promotion speech competition, invite enterprise teachers and competition instructors as judges, and score according to the scoring standards of speech competitions (language expression, logical thinking, on-the-spot adaptability, etc.), which not only tests the teaching effect but also improves students’ competition abilities.

## **3.5. Construct a diversified evaluation system**

The integration of “post, course, competition and certificate” advocates a learning concept closely linked to life experience<sup>[12]</sup>. It is necessary to construct a multi-dimensional, multi-subject and whole-process diversified evaluation system.

### 3.5.1. Clarify evaluation dimensions and subjects

Evaluation dimensions cover post-application abilities, basic language abilities, cross-cultural communication abilities, competition abilities, certificate examination levels and professional literacy; evaluation subjects are “diversified”<sup>[13]</sup>, including enterprise teachers, English teachers, competition judges, student groups and students themselves, forming a pattern of “multi-party participation and comprehensive evaluation”.

### 3.5.2. Formulate differentiated evaluation standards

Evaluation is a key link in the teaching process<sup>[14]</sup>. Enterprise teachers, English teachers and competition judges have rich professional knowledge and operational skills in their respective fields, and have a demonstration and leading role<sup>[15]</sup>. Enterprise teachers formulate evaluation standards for post application abilities and professional literacy, focusing on students’ performance in completing workplace tasks, communication etiquette and teamwork; English teachers formulate evaluation standards for basic language abilities; competition judges formulate evaluation standards for competition abilities, focusing on the fluency of language expression and the clarity of logical thinking.

### 3.5.3. Adopt diversified evaluation methods

Highlight the leading position of process evaluation (accounting for no less than 50%), and include students’ classroom performance, completion of practical tasks, small-scale competition results and certificate acquisition into process evaluation; summative evaluation adopts the form of “post skill simulation assessment”, with questions jointly set by enterprise teachers and English teachers, simulating real workplace scenarios to assess students’ comprehensive application abilities. Introduce value-added evaluation, pay attention to students’ progress and growth process, affirm students with weak foundations but obvious progress, and stimulate their learning motivation.

## 4. Conclusion

The integration of “post, course, competition and certificate” is an inevitable trend of vocational education curriculum reform and an effective path to improve the teaching quality of higher vocational public English. Higher vocational public English teachers need to base themselves on post needs, keep up with changes in industry development, competition and certificate standards, continuously optimize the curriculum system and teaching model, improve teaching quality, and contribute to cultivating high-skilled talents with workplace English application abilities and cross-cultural communication literacy.

## Disclosure statement

The author declares no conflict of interest.

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# AI-Enabled Teaching Reform and Practice of New Energy Courses: A Case Study of the “Hydrogen Powers the Future” Course

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**Abstract:** As an important part of the future energy system, hydrogen energy holds significant strategic significance in promoting energy structure transformation and achieving the “dual carbon” goals. University chemistry courses are the core carrier for cultivating scientific and technological talents in the hydrogen energy field, and their teaching content and methods are directly related to students’ knowledge mastery and the development of innovative capabilities. However, current hydrogen energy teaching in universities still faces problems such as fragmented content, insufficient depth, and disconnection between theory and practice, making it difficult to meet the talent demand amid the rapid development of the hydrogen energy industry. This paper first analyzes the main existing problems of hydrogen energy teaching in university chemistry courses, then proposes optimization strategies from aspects such as constructing a systematic and complete hydrogen energy knowledge system, innovating teaching methods, and strengthening practical teaching links. Meanwhile, combined with the development trend of educational digitalization, it explores the empowering role of artificial intelligence (AI) in hydrogen energy teaching, including intelligent knowledge system construction, AI-driven teaching model innovation, and the expansion of industry-education integration practice systems, providing new ideas for improving the quality of university hydrogen energy education. The research argues that, on the premise of ensuring scientific and basic teaching, cutting-edge, interdisciplinary integration, and intelligent educational concepts should be integrated to comprehensively enhance students’ theoretical literacy, engineering awareness, and scientific research innovation capabilities. The strategies proposed in this paper have certain reference value for promoting the construction of hydrogen energy talent training systems and supporting the high-quality development of the hydrogen energy industry.

**Keywords:** Hydrogen energy teaching; University chemistry education; Artificial intelligence; Teaching content reconstruction; Talent training

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## 1. Introduction

Against the background of in-depth adjustment of the global energy pattern and accelerated advancement of the “dual carbon” strategic goals, hydrogen energy, as a green, low-carbon, and widely applicable secondary energy source, is hailed as an important force driving the future energy revolution. China’s issued “Medium and Long-

Term Plan for the Development of the Hydrogen Energy Industry (2021—2035)” clearly proposes to cultivate the hydrogen energy industry into a national strategic emerging industry and a future industrial direction. The rapid development of the hydrogen energy field has put forward new requirements for university chemistry education: it not only needs to consolidate students’ theoretical foundation but also cultivate their innovative thinking, engineering capabilities, and interdisciplinary literacy, enabling them to be competent for the needs of future hydrogen energy technology R&D and industrial construction.

However, current hydrogen energy teaching in university chemistry courses still has problems such as fragmented content, insufficient depth, and weak practicality, making it difficult to meet the urgent demand for high-level talents amid industrial transformation and technological innovation. Therefore, systematically reconstructing the hydrogen energy teaching content system, innovating teaching methods, and strengthening industry-education integration practice have become important directions for university education reform<sup>[1–3]</sup>.

At the same time, the rapid application of artificial intelligence technology in the field of teaching provides a new path for hydrogen energy teaching reform<sup>[4]</sup>. AI has significant advantages in educational resource integration, intelligent content push, virtual experiment simulation, and scientific research assistance, offering strong support for breaking traditional teaching limitations and improving teaching efficiency<sup>[5–7]</sup>. Deeply integrating AI into hydrogen energy teaching not only helps the digital transformation and cutting-edge expansion of the content system but also promotes students’ active learning and the formation of scientific research capabilities, reserving more innovative talents for the development of the hydrogen energy industry<sup>[8]</sup>.

Based on this, this paper analyzes the current situation and problems of hydrogen energy teaching in university chemistry courses, and proposes feasible optimization strategies from aspects such as knowledge system reconstruction, teaching method innovation, practical link strengthening, and AI technology empowerment. It is hoped to provide a reference for universities to build a high-quality hydrogen energy education system and contribute educational strength to China’s energy transformation and development.

## **2. Current situation and problems of AI in university hydrogen energy education**

### **2.1. Initial application of AI technology, but limited coverage**

Currently, artificial intelligence technology has been initially applied in chemistry and energy education in some universities, such as using intelligent teaching platforms for personalized learning diagnosis and simulation software to assist virtual experiments of hydrogen energy reactions and equipment. However, overall, the popularity of AI in hydrogen energy teaching is still low, mostly remaining at the level of auxiliary display or simple data analysis, and has not formed a systematic intelligent teaching model. In addition, there are significant differences in resource construction among universities. Some institutions are unable to introduce mature AI educational tools due to technical, financial and other constraints, affecting the balanced advancement of AI teaching applications.

### **2.2. Imperfect teaching resources and data systems, unable to support in-depth, intelligent teaching**

Hydrogen energy education has strong cutting-edge and interdisciplinary attributes, and its AI teaching content should cover multiple directions, such as hydrogen production, hydrogen storage, fuel cells, and electrocatalysis. However, the current AI teaching resources directly available for hydrogen energy education are still relatively scarce. For example, the construction of experimental data, material databases, and mechanism models is not



complete, making it impossible to provide sufficient training samples for intelligent algorithms, such as machine learning. At the same time, some existing AI teaching systems lack a professional content update mechanism for the hydrogen energy field, resulting in teaching content being difficult to keep up with the rapid development of industrial technology, which restricts the improvement of students' scientific research and innovation capabilities by AI technology.

### **2.3. Lagging behind teachers' capabilities and teaching concepts, needing improvement in AI teaching integration**

Despite the significant teaching advantages of AI-assisted teaching, university teachers' capabilities and awareness of applying AI in hydrogen energy education are generally insufficient. On the one hand, many chemistry teachers lack an AI technical background, are not proficient in the use of intelligent teaching tools, and find it difficult to effectively integrate them into classroom teaching and scientific research training; on the other hand, teaching concepts still focus on traditional knowledge transmission, and insufficient attention is paid to the cultivation of students' intelligent capabilities such as data analysis and simulation design. In addition, the AI teaching evaluation system has not been improved, leading to insufficient motivation for teachers to innovate teaching and slow promotion of intelligent teaching methods.

## **3. Conception of AI-enabled reconstruction of hydrogen energy teaching content**

### **3.1. Construct an intelligent and systematic knowledge content framework**

In the reconstruction of hydrogen energy teaching content, full play should be given to the advantages of artificial intelligence technology in knowledge integration, content correlation, and visual presentation. Through intelligent curriculum resource platforms, hydrogen energy knowledge should be reorganized and processed in depth to form a scientific and hierarchical intelligent knowledge system. Content setting can rely on knowledge graphs to network and display core knowledge such as the basic properties of hydrogen elements, hydride chemistry, hydrogen production technology, and hydrogen storage and application systems, guiding students to achieve cross-level cognition from macro energy strategies to molecular-level mechanism understanding. At the same time, AI technology can be used to dynamically update teaching resources, incorporating the latest scientific research progress, standard systems, and industrial cases into the curriculum content in real time, making hydrogen energy teaching no longer limited to textbook knowledge but developing in an open and intelligent direction, fundamentally improving the scientificity and completeness of teaching content.

### **3.2. Enhance the advanced nature and academic challenge of content**

For the cultivation of high-level talents, the design of teaching content should emphasize the cognition of complex problems and the cultivation of scientific research capabilities. AI has powerful data analysis and model simulation capabilities, which can support the teaching process to break the traditional knowledge indoctrination model. For example, when explaining the electrocatalytic mechanism of fuel cells, introduce AI to assist in analyzing the relationship between electrocatalyst structure and activity, enabling students to use intelligent tools for calculation and prediction while understanding the theoretical basis, and put forward more innovative hypotheses and ideas in scientific research practice<sup>[9,10]</sup>. In addition, AI project-based learning tasks based on real data can be set, such as the optimization of hydrogen energy storage material performance and the construction of hydrogen production cost prediction models, transforming advanced knowledge into challenging learning

practices, and promoting students' transformation from "knowledge receivers" to "problem solvers".

### **3.3. Strengthen the cutting-edge and research-oriented orientation of curriculum content**

Hydrogen energy technology updates rapidly, so in content reconstruction, AI technology should be relied on to keep teaching content in sync with global scientific and technological progress. Teachers can use artificial intelligence to mine and analyze scientific research literature and patent databases, extract key breakthroughs and trends in the hydrogen energy field, and introduce content such as the development of new electrocatalytic materials, progress in large-scale solid-state hydrogen storage technology, and AI-assisted reaction path prediction into the classroom. At the same time, through AI simulation platforms, students can virtually build fuel cell devices and simulate electrocatalytic hydrogen production processes, experiencing the scientific research exploration process and enhancing their understanding and participation in real research<sup>[11,12]</sup>. Furthermore, the application of characterization methods such as mass spectrometry, gas chromatography, and XRD in hydrogen energy research can be displayed through intelligent experiment guidance systems, enabling students to clarify the logical basis and practical paths of hydrogen energy technology from the perspective of scientific research methods. Such settings not only enhance the inquiry and openness of the course but also lay an innovative foundation for students to carry out research in the hydrogen energy field in the future.

## **4. Optimization strategies for AI-enabled hydrogen energy teaching in universities**

### **4.1. Build an intelligent and multi-dimensional hydrogen energy knowledge system**

To meet the dual needs of educational digitalization and energy technology development, artificial intelligence should be fully used to optimize the construction of the hydrogen energy knowledge system. First, use knowledge graphs to realize the intelligent association of hydrogen energy-related concepts, mechanisms, and applications, enabling students to clearly understand the logical relationship between basic theories, technical routes, and industrial practices in hydrogen energy chemistry. Second, rely on AI content management platforms to dynamically update teaching resources, and automatically capture global hydrogen energy scientific research progress and technical patents through algorithms, keeping course content in sync with industry development. Third, promote inter-disciplinary data interconnection, such as introducing material science databases, electrocatalytic performance databases, and fuel cell simulation platforms, to achieve in-depth integration of interdisciplinary knowledge. Through intelligent resource integration, students can form a more comprehensive and systematic understanding of hydrogen energy, promoting the efficient construction of knowledge.

### **4.2. Innovate teaching methods to improve classroom participation and learning experience**

Innovation of teaching methods based on the advantages of AI technology is an important way to improve classroom efficiency. First, use intelligent learning analysis technology to provide students with personalized learning paths and ability profiles, enabling teachers to teach students in accordance with their aptitude and optimize teaching strategies. Second, develop AI-driven virtual simulation experiments, such as the simulation of electrocatalytic hydrogen production interface processes and the virtual regulation of high-pressure hydrogen storage systems, allowing students to observe micro-reaction mechanisms in a safe environment and enhance learning experience [13,14]. In addition, use AI to assist in designing project-based learning content, such as using machine learning to predict catalyst activity and optimize the energy output of fuel cell stacks, enabling

students to carry out inquiry-based learning around complex engineering problems. By introducing intelligent interaction and visualization technologies, classroom participation and learning effectiveness can be significantly improved, promoting the cultivation of students' active learning and critical thinking abilities.

### **4.3. Construct an industry-education integration intelligent practice system to enhance students' technical application capabilities**

AI technology plays an important role in practical teaching. On the one hand, intelligent monitoring and data collection systems can be integrated into hydrogen energy experiments, such as real-time tracking of hydrogen production rate and intelligent analysis of electrochemical tests, making experimental results more accurate and reliable, and helping students understand the scientific significance of data. On the other hand, relying on AI industrial simulation platforms, jointly build virtual production lines and project training courses with hydrogen energy enterprises, allowing students to experience the entire process of hydrogen energy equipment manufacturing, operation, and maintenance. At the same time, promote the joint construction of scientific research and innovation bases by universities and enterprises, encouraging students to participate in AI-assisted research on key hydrogen energy technologies, such as computational simulation of solid-state hydrogen storage and development of fuel cell fault diagnosis models<sup>[15]</sup>. Under the guidance of teachers and the collaborative participation of enterprise engineers, students can accumulate real scientific research and engineering experience, improve professional competence, and lay a solid foundation for future integration into the hydrogen energy industry.

## **5. Conclusion**

In summary, the application of artificial intelligence technology in university hydrogen energy teaching not only brings innovation to the presentation of knowledge but also provides important support for the cultivation of students' innovative capabilities, engineering practice capabilities, and interdisciplinary collaboration capabilities. Against the background of educational digital transformation and the rapid development of the hydrogen energy industry, universities should actively embrace AI technology, and through measures such as optimizing the teaching content system, innovating teaching methods, and strengthening practical teaching links, deeply integrate AI into the entire process of hydrogen energy talent training, promoting hydrogen energy education towards intelligence, precision, and high-quality development. It is believed that with the continuous maturity of AI technology and the deepening of hydrogen energy industry education, more high-level talents will be transported for the development of national strategic emerging industries, and universities will contribute to the realization of green, low-carbon, and energy transformation.

## **Disclosure statement**

The author declares no conflict of interest.

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# Reconstruction and Practice of Sustainable Teaching Pathways for Garment Construction Courses Supported by 3D Virtual Simulation in the Era of Intelligent Digitalization

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**Abstract:** In the era of intelligent digitalization, technologies such as artificial intelligence, big data, and virtual simulation have profoundly reshaped the ecosystem of fashion design education. The textile and apparel industry's pursuit of green, low-carbon, and intelligent development continues to drive a systematic transformation in the knowledge structure, pedagogical approaches, and talent-training models of fashion design programs. Traditional fashion design education centered on skill training alone can no longer meet the future fashion industry's demand for digital-intelligence-driven, interdisciplinary, sustainability-oriented, innovative talent. Taking university-level courses in Garment Construction as a case study, this paper explores the reconstruction of sustainable teaching pathways and systemic reform of technical courses supported by 3D virtual simulation technology. Through literature review and pedagogical practice, the study elaborates on a three-dimensional framework of sustainable teaching objectives, encompassing knowledge, skills, and values, across the dimensions of curriculum philosophy, learning goals, and technological support. It further proposes a curriculum transformation strategy centered on the "logic of sustainable garment structure design for the future" and establishes a five-dimensional integrated teaching model as an implementation framework. The findings reveal that the integration of 3D virtual simulation technology not only optimizes material utilization and enhances process visualization in garment technology instruction but also fosters students' coordinated development in structural cognition, design innovation, and sustainability awareness. This study provides a systematic model and practical reference for the diversified and sustainable reform of Garment Construction courses, offering valuable insights into promoting the green transformation and digital-intelligent integration of fashion education.

**Keywords:** Intelligent digital era; 3D virtual simulation; Sustainable fashion education; Garment Construction course; Teaching pathway reconstruction

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## 1. Introduction

With the rapid development of the global economy, excessive resource consumption and environmental



degradation have become serious threats to humanity, compelling society to re-examine the relationship between people and nature. In response, industries across the board have begun to adopt the principles of sustainable development in an effort to reduce energy consumption and carbon emissions. As a low-carbon, environmentally friendly, and circular design philosophy, sustainable fashion design has gradually evolved into a core direction for the future development of the fashion industry. In the 21st century, influenced by artificial intelligence, big data, virtual simulation, and the rise of sharing and circular economy models, sustainable fashion design has been endowed with new meanings and developmental orientations, exhibiting a dual-driving trend of “technological empowerment and ecological rationality.” Against this backdrop, the sustainable transformation of China’s textile and apparel industry remains at the stage of conceptual introduction and localized pilot implementation. The number of fashion designers equipped with systematic, sustainable design thinking and practical competence is still limited, and the existing fashion education system has yet to provide effective structural support. As a result, how to seamlessly and implicitly integrate sustainability concepts into the curriculum of fashion design programs has become a focal issue in both academia and education.

Taking university-level courses on Garment Construction as a case study, this research creatively integrates sustainability concepts into the teaching system, exploring new pedagogical pathways for green reconstruction of teaching content and sustainable cognitive transfer in the context of the intelligent digital era empowered by 3D virtual simulation technology. By developing a teaching model grounded in virtual–real integration, conceptual embedding, and reflective transfer, this study expands the scope and depth of sustainable fashion education. The proposed model serves as a reference framework for nurturing a new generation of interdisciplinary fashion designers in China who integrate ecological responsibility with creative and structural innovation.

## **2. Current status and challenges of sustainable teaching in fashion design courses in the era of intelligent digitalization**

In recent years, with the advancement of the United Nations Sustainable Development Goals (SDGs) and the deepening of educational digitalization, sustainable fashion design education has emerged as a prominent research focus within the global academic community, exhibiting a dual-driving trend of technological integration and emotional engagement. According to a study conducted in Poland by Murzyn-Kupisz and Hołuj (2021), more than half of European fashion design institutions have incorporated topics such as environmental sustainability, ethical production processes, and resource conservation into their formal curricula, rather than limiting them to elective or extracurricular courses. In Portugal’s Fashion Design Technician Course (FDTC) vocational education program, a survey of 40 local instructors revealed that 82.5% of respondents had integrated circular economy and sustainability issues into their classroom teaching activities <sup>[1]</sup>. Many researchers have since focused on transforming environmental awareness and ecological design responsibility into new pedagogical objectives, developing sustainability-oriented curriculum modules and knowledge frameworks to guide ongoing educational reforms <sup>[2]</sup>.

The author’s review indicates that current research in this field primarily concentrates on four key areas: (1) The construction of emotionally driven models for teaching circular design; (2) The practical application of 3D virtual simulation technologies in sustainable design education; (3) The development of multidimensional evaluation systems for effectively assessing students’ learning outcomes and motivational engagement; (4) The exploration of culturally and ethically oriented pathways for sustainable instructional design. Korean scholar Lee Hyewon (2025) proposed an emotionally driven model for sustainable design education, suggesting that textile

waste can be transformed into a combination of “digital emotion + physical entity” to foster students’ emotional connection with discarded clothing materials <sup>[3]</sup>. Wang Mengyuan (2023) from the University of Surrey in the United Kingdom redefined the role of virtual fashion experiences in sustainable education, emphasizing students’ learning processes as they relate to social structures, cultural values, and identity formation within the context of sustainability. Chinese scholar Jiang Dongdong (2023) advocated for the systematic integration of sustainable development principles into the learning objectives of creative fashion design courses, proposing an organic fusion of creativity and functionality, and of environmental awareness and aesthetics—thereby challenging the traditional design paradigm that prioritizes aesthetics above all else. Although research on sustainable fashion design education continues to deepen both domestically and internationally, the field still faces a range of theoretical and practical challenges.

At present, the core challenge lies in achieving a deep integration among concepts, technologies, and pedagogical logic. In Chinese higher education, reforms toward sustainability in fashion design curricula largely remain at the stage of conceptual introduction or localized experimentation. The structural optimization of teaching systems and the holistic integration of sustainability into curriculum design are still insufficient. Sustainability is often treated as “supplementary knowledge” rather than as the core value driving the reconstruction of pedagogical logic. Furthermore, scholars widely acknowledge that sustainable fashion education constitutes an inherently interdisciplinary and systemic endeavor—one that requires not only instructors with solid professional backgrounds in fashion design, but also educators who possess a thorough understanding of sustainability principles and digital-intelligence technologies. However, in many Chinese fashion colleges, faculty members still exhibit relatively narrow knowledge structures and rely on traditional teaching methods—limitations that significantly constrain the innovative implementation of sustainable pedagogical practices <sup>[4]</sup>.

### **3. Advantages of applying 3D virtual simulation technology in the sustainable transformation of garment construction education**

3D Virtual Simulation technology represents an innovative educational approach that integrates artificial intelligence, big data, and immersive interaction. Its core advantages—high visualization, strong interactivity, instant feedback, and reproducibility—make it particularly well suited to the evolving demands of fashion design education. Platforms such as Style3D and CLO3D exemplify how virtual garment modeling technologies enable real-time multimodal linkage and dynamic mapping among 2D garment patterns, 3D virtual forms, and technical processes. This allows students to comprehend garment structural principles through an experiential learning process characterized by “seeing, modifying, and verifying.” Sustainability has long centered on the principles of resource efficiency and circularity, and 3D virtual simulation technology provides a powerful means to realize these goals within fashion education <sup>[5]</sup>. It enables the quantifiable assessment of material consumption throughout the learning process. Within a virtual environment, students can use parametric tools to simulate various structural schemes, compare material utilization rates, and evaluate the complexity of different production workflows—thus verifying the sustainability and adaptability of their structural solutions in advance. This cyclical experimental mechanism of “virtual experimentation – data feedback – structural refinement” greatly enhances the environmental responsibility embedded in garment technology teaching. Moreover, it provides both technical support and a digital visualization pathway for integrating sustainability into curriculum design, fostering a teaching model that unites ecological awareness with technological innovation and advances the sustainable transformation of fashion education <sup>[6]</sup>.

## **4. Course orientation and teaching objectives of garment construction under the guidance of sustainable design concepts**

The Garment Construction course is a core component of fashion design programs in higher education. It serves as a crucial bridge guiding students from perceptual modeling in design toward rational structural construction, as well as a key transitional stage linking design concepts to technical realization. Under the guidance of sustainability-oriented design thinking, the teaching objectives of this course go beyond the conventional transmission of technical skills such as pattern drafting, cutting, and sewing techniques. Instead, the course emphasizes cultivating students' spatial reasoning and problem-solving abilities through the logical framework of sustainable design. This course is primarily designed for fashion design students who have already completed foundational courses such as fashion modeling design, color composition, draping, and basic design principles<sup>[7]</sup>. It aims to help them integrate structural logic, ecological awareness, and technological application into a unified learning system that supports innovative and sustainable approaches to fashion creation.

### **4.1. Three-dimensional framework of teaching objectives: Synergistic construction of knowledge, skills, and values**

In general, the teaching objectives of garment technology courses in higher education are to help students develop a systematic understanding of the structural principles and technical logic underlying garment design. Through structured training in construction theory and production processes, students learn the underlying rules governing garment form, material properties, and manufacturing procedures, thereby establishing a comprehensive cognitive framework of garment technology. With the integration of sustainability concepts, the course embeds green design awareness and resource conservation into every stage of the teaching process. It emphasizes structural rationality as a driving force for creative design, cultivating versatile fashion designers who possess structural analytical ability, technical implementation skills, and innovative application competence. This is achieved through progressive learning that interconnects technical reasoning, design innovation, and sustainable value creation.

Overall, the sustainability-oriented Garment Construction course is guided by a three-dimensional framework centered on the synergistic development of “knowledge, skills, and values.”

#### **(1) Knowledge Objective**

To master the fundamental principles of Garment Construction; understand pattern construction rules and the complete process of garment production; and comprehend the logical relationships among structure, form, and material.

#### **(2) Skill Objective**

To develop the ability to independently draft women's wear prototypes and perform fundamental sewing operations, as well as to verify structural accuracy and optimize technical processes in both virtual and physical environments.

#### **(3) Value Objective**

To cultivate forward-looking and sustainability-oriented thinking in garment structure design; to internalize the understanding that “sustainability is an inherent design responsibility”; and to build the comprehensive capability to transform creative concepts into technical and practical design expressions.

### **4.2. Green reconstruction of course content: A resource-efficient path integrating materials, structure, and technology**

In traditional fashion design education, Garment Construction courses have often emphasized technical

metrics such as accuracy, speed, and process precision while neglecting ecological dimensions such as material waste, energy consumption, and structural efficiency. Guided by the principles of sustainability, the Garment Construction course now shifts its focus from purely technical skill training to a dual emphasis on resource efficiency and ecological rationality. The green reconstruction of course content not only involves adjusting individual teaching modules but also reconfiguring the underlying logic of the knowledge system itself. This transformation replaces the traditional linear sequence of “design–pattern making–production” with an integrated and resource-conscious framework of “materials–structure–technology”<sup>[8]</sup>. The core value of this green restructuring lies in making the course content itself a carrier of sustainability concepts. In this way, students can build cognitive connections between structural rationality and ecological efficiency, cultivating an awareness of resource conservation and developing sustainable judgment rooted in rational design thinking.

#### **4.3. Digital-intelligent integration of teaching strategies: Synergizing implicit conceptual embedding and technological scaffolding**

Complementing the greening of course content, innovation in teaching strategies lies in shifting the transmission of sustainability concepts from explicit instruction to implicit construction. 3D virtual simulation technology provides a digital-intelligent scaffold for this transformation, enabling educators to naturally integrate awareness of conservation and ecological reasoning into students’ learning experiences through a cyclical model of “context–task–feedback–reflection.” The instructional design is characterized by task orientation and data-driven learning. As students engage in virtual garment structure design and process optimization, the system provides real-time feedback on quantifiable indicators such as fabric utilization rate, production time, and fabric waste ratio. Teachers then use these data, together with peer evaluation mechanisms, to guide students in reflectively assessing the sustainability of their design solutions—transforming green awareness into structural design logic. Through this process, digital-intelligent integration achieves a two-way fusion of technology and sustainability concepts, reshaping learners’ cognitive patterns and making sustainable design education a genuinely internalized process—one that becomes embodied in both thought and practice.<sup>[9]</sup>

### **5. A five-dimensional integrated sustainable teaching model for Garment Construction courses based on 3D virtual simulation and its practice**

This study proposes a five-dimensional integrated sustainable teaching model for Garment Construction courses, grounded in 3D virtual simulation technology. The model aims to advance the sustainable development of fashion design education through the deep integration of digital and virtual simulation technologies. Its core concept is to cultivate students’ sustainable design thinking and strengthen their green values—from conceptual design to technical implementation—through five progressive teaching modules. Each module builds upon the previous one, emphasizing energy conservation, eco-friendly craftsmanship, and structural innovation.

#### **5.1. Module A: Garment structure experimentation and the cultivation of resource-conservation awareness**

As the starting point of the course, Module A focuses on garment structure experimentation and the cultivation of awareness regarding material and process efficiency. The goal is to help students understand, through 3D virtual simulation, the causal relationship between structural decisions and material conservation, thereby forming an initial perception of sustainability<sup>[10]</sup>.



At the beginning of the module, instructors guide students to research literature and design cases related to zero-waste and sustainable structural design, encouraging autonomous learning and conceptual familiarity. In class, guided by the core task of “identical forms, different structures,” students use a 3D virtual platform to compare how various garment structural compositions and production process schemes affect factors such as fabric utilization rate and manufacturing time. Through this comparative experimentation, students gradually develop sustainability-oriented design thinking in garment structuring. After class, they analyze material and energy-saving effects and record their findings in experimental reports. In this stage of structural experimentation and comparative learning, students gain a practical understanding of the logic of resource-efficient design, laying a solid cognitive foundation for creative exploration and sustainable innovation in the subsequent modules.

## **5.2. Module B: Integrating creative structural design with sustainable thinking**

Cultivating innovative thinking in garment structural design has always been one of the core objectives of fashion technology courses in higher education. A designer who focuses solely on sketching stylistic designs, without understanding pattern communication or effectively translating design intentions into structural solutions, cannot achieve true creative realization. Observations reveal that many fashion design students in universities lack innovative thinking centered on structure. A prevalent misconception among students is that design innovation stems primarily from fabric manipulation or surface pattern design, which reflects a significant gap in professional understanding<sup>[11]</sup>. Module B focuses on developing students’ capacity for structural design innovation and serves as a pedagogical bridge from resource-efficiency experimentation to structural creativity. Its core objective is to foster the ability to balance structural rationality, creative expression, and sustainability. In the instructional design, the module follows the main learning pathway of “structural variation and form recombination.” Using 3D virtual garment modeling systems, students conduct experiments in virtual environments involving seamline transfers, pleat reconstructions, and cutting recombinations. By applying single-variable controls to structural parameters, students explore how sustainability principles can be structurally embodied, evaluating their designs based on two key dimensions: material utilization efficiency and form innovation.

At the same time, the module incorporates learning activities such as parametric form reconstruction, ecological form-language analysis, and comparative studies of international fashion brands’ green structural innovations. These experiences guide students to deepen their understanding of the relationship between structural innovation and sustainable value through cycles of analysis, experimentation, and reflection. The core intent of this module is to integrate structural experimentation with virtual validation, encouraging students to internalize resource conservation as the starting point of creative thinking. Ultimately, this enables the formation of a sustainability-driven logic of structural creativity, achieving a cognitive shift from “awareness of green design” to “expression of structural innovation.”

## **5.3. Module C: Green substitution and cognitive reconstruction in garment manufacturing processes**

Sewing technology is a crucial link in transforming creative design into tangible garments. Traditionally, sewing courses in fashion programs have relied heavily on industrial flat sewing machines for hands-on process training, while paying little attention to the future significance of these skills or the technological advancements shaping contemporary manufacturing. Module C centers on optimizing garment manufacturing processes. Its instructional focus lies in using 3D virtual garment modeling and simulation technologies to help students recognize differences in energy consumption and environmental impact among various process pathways,



thereby reshaping their understanding of traditional production concepts. The course also introduces cutting-edge sustainable garment-making methods currently adopted or emerging in the industry, such as heat bonding, seamless joining, and detachable construction<sup>[12]</sup>. Through virtual experiments comparing conventional sewing workflows with streamlined or alternative methods, students gain a deeper understanding of how digital production management contributes to sustainable manufacturing practices. The objective of this module is to cultivate students' ability to make scientifically grounded technical judgments through experimentation and case analysis. It challenges the conventional notion that "refinement equals complexity" and instead emphasizes that "simplicity, recyclability, and low energy consumption" constitute the fundamental logic of modern sustainable garment craftsmanship. Through green process substitution and virtual cognitive training, students progressively develop a process-oriented mindset guided by energy-efficiency optimization, thereby laying the groundwork for subsequent modules focused on structural integration and innovative design development.

#### **5.4. Module D: Structural logic construction and sustainable cognitive transfer**

In Garment Construction education, structural logic capability serves as the core foundation connecting creative fashion expression with technical implementation. Module D aims to establish a systematic structural reasoning framework through structural deduction and digital visualization technologies, enabling students to develop transferable structural logic that spans across materials, styles, and contexts. The emphasis is on helping students understand that all fashion design expressions must ultimately be realized through structural logic—structure is not subordinate to garment silhouette, but rather the prerequisite for silhouette formation<sup>[13]</sup>.

##### **(1) Constructing a "Dynamic Structural Logic" System Using 3D Virtual Simulation as Cognitive Scaffolding**

Module D employs 3D virtual simulation technology as cognitive scaffolding, utilizing CLO 3D and Style3D to construct a visualized "dynamic structural logic" system. This enables students to understand the causal relationship between pattern structure and garment form within a real-time mapping environment. Through 2D-3D interactive demonstrations of subtle pattern adjustments, instructors guide students to conduct quantitative analysis of material consumption, fabric waste rates, and manufacturability across different structural solutions. This approach helps students develop systematic design decision-making capabilities that integrate structural reasoning, silhouette assessment, and sustainability optimization.

##### **(2) Problem-Driven Structural Logic Training: Reasoning-Based Learning from Sketch to Structure**

The module introduces various interactive teaching scenarios that use "problems" as drivers to strengthen students' ability to analyze form from a structural perspective. Real assessment tasks and AIGC comparative analysis are employed to establish structural logic awareness. The instruction begins with the guiding question: "Which fashion illustrations cannot be structurally realized?" Students are presented with design sketches or AI-generated images to identify structural impossibilities, thereby recognizing that visual forms do not equate to structural manufacturability<sup>[14]</sup>. Subsequently, students engage in "Abstract Sketch to Structural Solution Reasoning" tasks, using generative AI software to convert random sketches into garment realization proposals. Through comparing human-generated and AI-generated results, students understand AI limitations and the irreplaceable nature of structural thinking during this comparative process. This task-based training helps students recognize the importance of structural learning while enhancing their ability to assess design feasibility from a structural perspective.

### (3) Building Cross-Contextual Sustainable Structural Awareness Through “Cutting-Edge Design Cases”

The curriculum incorporates cutting-edge fashion master cases to cultivate sustainable structural design awareness. Through analyzing Rei Kawakubo’s anti-structural experiments, Iris van Herpen’s structure-material integration strategies, and Issey Miyake’s origami garment creative systems, students learn that complex silhouettes do not rely on decorative accumulation but stem from functional innovation in structural cutting methods, body curves, and material properties. The course engages students in deconstructing classic international silhouette structures, simulating morphological differences created by structural line variations, and ultimately understanding that structural innovation is not only the essence of silhouette breakthroughs but also an important pathway for sustainable design.

## **5.5. Module E: Comprehensive implementation of sustainability-themed garment construction design teaching**

The systematization of structural logic and the transfer of sustainable cognition constitute a vital bridge between fundamental garment construction skills and holistic innovative design. The central aim of this module is to guide students in systematically integrating the fragmented knowledge acquired in previous modules, such as structural efficiency, green craftsmanship, and creative expansion, into a coherent and unified knowledge framework that interconnects structure, process, and sustainability. Students are further encouraged to apply this integrated framework to the deconstruction and analysis of classic designs and complex silhouettes, thereby progressing from passive reception to active analysis and innovation. In its instructional design, the module introduces product life-cycle thinking as a key conceptual foundation. This approach urges students to extend their perspective beyond garment design and construction to include the entire life span of a garment—its use, maintenance, and end-of-life recycling or disposal. A major strategy for facilitating cognitive transfer in this module is the “Deconstruction and Reconstruction” workshop. In these sessions, instructors lead students in digitally deconstructing representative works from leading international fashion houses, examining their underlying structural logic and craftsmanship decisions. Guided by the principle of sustainable optimization, students then re-envision these garments through structural simplification or green process substitution, and test the feasibility of their redesigned versions within a 3D virtual simulation environment. Chinese traditional culture has long embraced the philosophies of “cherishing materials” and “making the best use of things,” which offer profound inspiration for contemporary sustainable design. Through comparative case studies under the theme “From Tradition to Sustainability,” instructors guide students to explore how cultural heritage and sustainable logic can be organically integrated. This process enables students to achieve a deep cognitive transfer—transforming sustainability from an abstract ideal into an internalized design philosophy that informs creative practice. The pedagogical design of Module E seeks to complete the closed-loop structure of the entire teaching model, enabling students to achieve a comprehensive transformation from conceptual understanding to innovative application through experiential practice. Ultimately, it cultivates an integrated competency framework that unites “structure-driven design, process-supported execution, and sustainable expression.” Through this holistic learning process, students not only strengthen their capacity for creative implementation but also develop the professional competence and social responsibility necessary to contribute meaningfully to the sustainable transformation of the future fashion industry.

## 6. Conclusion

Anchored in the context of the intelligent digital era, this study has explored how 3D virtual simulation technology can serve as a foundation for reconstructing the teaching pathways of Garment Construction courses through the integration of sustainability concepts. A five-dimensional integrated sustainable teaching model was developed to provide both theoretical guidance and practical application. Through literature review and pedagogical practice, the study found that Garment Construction education can, within a virtual environment, achieve more efficient resource utilization and process optimization. This not only enhances students' understanding of garment structure and process logic but also promotes the coordinated development of structural cognition, design innovation, and sustainability awareness. During course implementation, instructors employed a modular teaching framework to progressively cultivate students' cognitive transition from structural decision-making to sustainable design thinking<sup>[15]</sup>. This approach effectively strengthened students' innovative capacity, awareness of resource conservation, and ability to integrate systems knowledge across design and production processes.

Looking toward the future, teaching in Garment Construction will enter a new stage characterized by the deep integration of technology and sustainability concepts, giving rise to more diversified and flexible modes of exploration. The boundaries between professional courses will become increasingly fluid, with a greater emphasis on “application and evaluation” rather than merely “learning and doing.” As virtual simulation, artificial intelligence, and big data technologies continue to advance in synergy, the key question for future fashion designers will be how to effectively utilize environmental and digital tools to enhance their own capabilities. Interdisciplinary and collaborative educational models will foster a new generation of designers equipped with both innovative thinking and ecological responsibility, thereby driving the sustainable transformation and long-term evolution of the fashion industry.

## Disclosure statement

The author declares no conflict of interest.

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