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VR-Based Innovation in University Music Practice Teaching: Exploration and Reflection

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Abstract: At present, university music education is facing the challenge of digital transformation and urgently needs to achieve upgrading and change at multiple levels by leveraging new technologies and new development concepts. Integrating virtual reality technology into the practical teaching process of music in colleges and universities is a new direction for exploring the construction of art courses and has certain value and significance. This paper, guided by national policies such as the “Opinions of the Ministry of Education and Other Nine Departments on Accelerating the Digitalization of Education”, the “14th Five-Year” digital economy development plan, and the “Opinions on Comprehensively Strengthening and Improving Aesthetic Education in Schools in the New Era”, starts from the current situation of practical music teaching in colleges and universities, takes virtual reality technology as the core support, focuses on the construction and exploration of innovative paths for practical music teaching, and at the same time explores practical problems and reflection points in the application process of virtual reality technology, and proposes relative optimization strategies to further promote the practical teaching of music in colleges and universities to a new stage.

Keywords: Virtual reality (VR); Information technology; University; Practical music teaching; Innovative paths

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1. Introduction

With the continuous development of science and technology and the constant advancement of the national digital education policy, integrating virtual reality technology into the music practice teaching system of colleges and universities promotes the deep integration of information technology and art education^[1]. At present, developing digital teaching resources and building a new model of digital teaching are becoming important paths for the innovative development of music education and teaching in current higher education institutions. As the core carrier of digital education, virtual reality technology, with its characteristics of “multi-sensory interaction” and “spatio-temporal reconstruction”, not only breaks through the limitations of

educational space, but also its strong interactivity and high operability are highly consistent with the demands of “contextualized experience”, “personalized training”, and “cultural inheritance” in the practical teaching of music in colleges and universities ^[2]. This can not only stimulate students’ strong interest in learning and broaden their learning channels, but also provide strong support for teachers’ teaching, implement policy requirements, and serve as a key technical support for upgrading practical teaching, thereby promoting the overall teaching to move towards a new stage of efficient and high-quality development.

2. The adaptability of virtual reality technology to university music education

At present, virtual reality technology has become a new educational means to promote the innovation of music practice courses in universities. By leveraging virtual reality technology, an “immersive” music practice scene can be created for students, and a visual “situational channel” can be constructed to deepen artistic aesthetics and cultural understanding ^[3]. Cultivate students’ ability to actively perceive and explore musical skills in immersive experiences, and fully stimulate their enthusiasm for learning in various music practice courses. The immersive, interactive, and imaginative features of virtual reality technology are highly compatible with the perception, skills, and innovation demands of university music teaching, jointly forming a solid theoretical support.

3. The current situation of university music practice courses and the demand for the application of virtual reality technology

3.1. The current situation of university music practice courses

At present, some universities in China still follow a single traditional teaching mode in music teaching. This teaching mode not only makes it difficult to innovate in teaching but also lags behind the market demand for music talents. If in vocal music teaching, the emphasis is placed on the teacher’s empirical demonstration and explanation, students will find it difficult to directly observe the movement trajectories of the vocal organs and have difficulty further understanding and applying the abstract explanations. In the piano practice courses of colleges and universities, there is a reliance on teachers’ demonstration and explanation, lacking multi-angle and data-driven teaching presentations. Some students majoring in music performance, due to the lack of stage practice training, suffer from emotional tension, lack of self-confidence, and weak psychological quality during on-the-spot performances. In other music practice courses, such as choral conducting rehearsals, duets and opera rehearsals, and improvisational accompaniment, although the forms vary, the common demands are unified. However, under the traditional teaching mode, due to issues such as teacher allocation, experimental equipment, and rehearsal venues, the course teaching lacks innovation. The above-mentioned problems vividly reflect the urgency of the reform of practical teaching. By innovating music practice teaching through modern information technology means and developing virtual teaching practice venues, teachers and students can transform into each other in both teaching and learning, achieving comprehensive development of students in terms of professional skills and practical competitiveness.

3.2. Demands for virtual reality technology applications

In the comprehensive university music courses, in addition to professional skills, some professional elective courses can also use virtual reality technology for teaching reform. A virtual visualization system of vocal organs was developed to display the relationship between vocal movements and sound waveforms in real

time through 3D models. The virtual concert hall scene was constructed to simulate the acoustic feedback and visual pressure environment of different sizes of audience seats. Combined with motion capture technology, the teacher's standard finger-pointing was transformed into virtual cursor guidance and strength display, and the comparison of students' action trajectories was superimposed. A multi-track virtual ensemble system was designed to support students in controlling the volume of different voice parts independently and intuitively understanding the relationship between voice parts. A virtual instrument simulator is developed to build a multi-person synchronous virtual rehearsal room, which supports low-latency audio and video interaction and real-time music notation^[4]. Modern information technology can make students have a better experience in the learning process, to improve the teaching effect.

4. The innovative path of music practice teaching based on virtual reality technology

4.1. Innovative path of vocal music practice teaching empowered by virtual reality technology

Virtual reality technology, with its characteristics of immersion, interaction, and conception, provides a new possibility for vocal music practice teaching. To promote the development of teaching personalization through data analysis. Focusing on the actual situation of students, virtual singing scenes with simulated acoustic effects are built. With the help of the atmosphere created by different singing environments, singers are inspired to actively adjust the softness of the timbre, so that the voice is more delicate and appealing, and the scene empowers the voice^[5]. At the same time, with the help of virtual reality technology, the idea of visual and tactile feedback is integrated to realize a multi-dimensional sensory experience and strengthen the three-dimensional nature of artistic perception. For example, through the innovative integration of virtual reality technology and opera works, multi-dimensional interactive scenes are built through multi-sensory channels, and art scenes that fit the opera plot are built independently in the virtual scene. At the same time, lighting and sound effects are adjusted accurately with the help of digital technology to achieve an emotional resonance experience. Virtual reality technology can also combine with AI technology to analyze students' performance in the process of vocal singing in real time, such as intonation, rhythm, and phonation position, and give timely, targeted feedback, customize exclusive practice content, personalized guidance and appropriate practice content, and effectively mobilize students' learning enthusiasm, to achieve accurate and efficient teaching.

4.2. The innovative path of piano practice teaching is supported by virtual reality technology

Virtual reality technology teaching breaks the limitations of the traditional piano classroom, takes students' hands-on practice as the core, fully releases students' perceptual thinking, and stimulates creativity. Virtual disassembly and assembly of piano parts, familiar with the internal and external form of the instrument from multiple angles, the corresponding working principle, guide students to experience the immersive scene, feel the real visual effects, and stimulate students' interest in learning. At the same time, the virtual reality technology can create diversified teaching scenarios, according to the different ages and styles of work to build different music scenes, such as a virtual concert hall, an ensemble rehearsal room, different styles of play stage, overall layout, and details of these virtual scene spaces, scene environment highly consistent with

reality. When students play the piano ensemble in the virtual concert hall, they can not only hear the real echo of the ensemble sound, but also observe the immediate reaction of the virtual ensemble players. Under this experience, students can subjectively feel the atmosphere of piano performance and the synergy of the instrument ensemble. In addition, in the process of piano classroom teaching, teachers combine virtual reality technology teaching to cultivate students' comprehensive music literacy. The construction of virtual reality technology spans the historical "situational channel" and guides students to "enter" the composer's era context, and truly feel the social environment and cultural trend of the work creation.

4.3. Innovation path of virtual reality technology to help other music practice courses

Virtual reality chorus rehearsal simulation successfully breaks through the traditional rehearsal in time and space restrictions, and also solves the dependence on hearing. With the help of virtual technology to visualize the acoustic atlas, the abstract intonation is transformed into intuitive visual signals, which effectively help to improve the efficiency and accuracy of intonation and voice training. The application in the teaching process of duet and opera rehearsal realizes the interaction between students and opera characters in the virtual environment, provides a more realistic visual and auditory experience, a multi-sensory experience of the richness of opera, an in-depth understanding of the characteristics of opera characters, and promotes collaboration between students. Students can continue to carry out virtual concerts after class, wear VR headsets, experience the singing scene in an immersive way, develop a new performance cooperation mode, and obtain the experience of stage performance. Virtual reality technology has also achieved remarkable results in the teaching of improvised accompaniment. Through this technology, students can experience various musical environments, simulate the performance scenes, enhance their ability of music perception, and carry out relevant evaluation and feedback. Teachers can adjust teaching methods in time and solve problems in a targeted manner. It can be seen that the application of virtual reality technology in the teaching of music practice courses has greatly improved students' autonomous learning ability and exploration ability, and made forward-looking exploration for music practice teaching.

5. Practical reflection and optimization strategies of virtual reality technology

5.1. Reflection on issues arising during application

First, in terms of technical adaptation, the acoustic modeling of existing VR devices has certain differences in accurately restoring the subtle timbre of different Musical Instruments, easily leading to "timbre distortion" of virtual Musical Instruments and auditory cognitive bias. Due to the extremely high demand for "millisecond-level motion accuracy" for instruments such as pianos and bowed string instruments, ordinary VR motion capture systems have a delay of 50 to 100 milliseconds, which may cause the student's movements to be out of sync with the sound output. The adaptation design of the VR teaching system to "tactile feedback" and "force feedback" needs to be strengthened. Second, the teaching cost is relatively high. The VR teaching module requires the collaborative work of teachers, 3D modelers, acoustic engineers, etc. In the later stage, the instrument physics engine also needs to be continuously updated, which incurs high costs and is difficult for local colleges and universities or non-key majors to bear. At present, music colleges and a few universities have incorporated this technology and carried out teaching and interdisciplinary project exploration. Third, in terms of the acceptance of teachers and students, some teachers have "substitution anxiety" for VR technology,

fearing that the virtual system will weaken the value of teachers' "personalized guidance." Meanwhile, teachers need to learn additional VR equipment operation and content production, which increases the time of lesson preparation.

5.2. Path optimization strategy based on reflection

According to the reflection of current virtual reality technology in teaching, the following optimization strategies can be adopted. Development of music music-specific acoustic engine for technical adaptation optimization. Optimize VR acoustic models based on the characteristics of Musical Instruments. For instance, design an "action physical feedback system" for pianos to simulate the rebound speed of hammers when keys are pressed with different forces. Develop a "resonance cavity acoustic parameter library" for vocal music, and preset virtual resonance effects for different voice parts such as tenor and mezzo-soprano. Adopt a low-latency motion capture solution using "hybrid positioning technology." Basic motion capture uses a low-cost camera +AI algorithm, and uses dedicated sensors superimposed on core accuracy requirements (such as finger touch state in piano discipline) to reduce latency and ensure that core actions are synchronized with sound. Carry out a multi-modal interaction hierarchical design, and realize different sensory feedback such as auditory, visual, tactile, force feedback, and olfactory simulation according to the priority of course requirements.

According to different teaching objectives, the hardware configuration gradient controls the teaching cost. The basic version is suitable for a mobile phone VR box + ordinary camera, and lightweight contents such as "2D virtual teacher demonstration" and "simplified version of vocal organ animation" are developed. The cost of single equipment is controlled at a lower price, which is used for public elective courses or for beginners. The professional layout is oriented towards performance majors, equipped with headsets and motion capture devices, focusing on the high-precision demands of the discipline. In collaboration with multiple universities, a "VR Music Teaching Resource Alliance" was established, with a division of labor to develop modular content. Resources were shared through a cloud platform to reduce development costs. At the same time, an "open source community" mechanism is introduced to encourage teachers and students to upload self-made VR teaching materials.

The mechanism of "experience feedback-fast iteration" was established, anonymous feedback of teachers and students on the VR teaching system was collected regularly, and targeted optimization was carried out with the technical team to improve the acceptance of teachers and students. Launch "VR Teaching Workshops" to train teachers to independently design teaching scenarios using simple tools, enabling teachers to transform their roles from "skill transmitters" to "VR teaching designers." Transform teachers' "empirical knowledge" into "interactive teaching modules" in VR to strengthen teachers' leading position in the application of technology. The closed-loop student training system of "VR pre-training → real instrument practice → VR disk optimization" is adopted. The "action error report" is generated by correcting the basic action through the virtual system. Under the guidance of the teacher, the real instrument is used to verify the improvement effect in the class. The real performance video is recorded and compared with the VR standard action to generate the "virtual and real comparative analysis report."

6. Conclusion

Standing at the historical juncture of the digital transformation of education, virtual reality technology is

reshaping the genetic structure of music practical teaching. The application of virtual reality technology in college music practice teaching needs to break through the misunderstanding of “technology first” and return to the essence of “teaching demand as the core”^[6]. By adapting customized technologies to solve the problem of “the particularity of music scenarios”, lowering the threshold for implementation through gradient cost control, and resolving the resistance of traditional teaching habits through a teacher-student collaboration mechanism, the deep integration of VR technology and the laws of music education is ultimately achieved, making it a truly innovative tool that “empowerment rather than replacement.” In the future, we should focus on the cross-research of musicology and VR: building the metaverse education ecology, developing distributed virtual scenes that support ten thousand people’s concurrency; realizing real-time AI rendering of personalized teaching scenarios; integrating brain-computer interface technology to explore the possibility of controlling virtual Musical Instruments with thoughts. However, technology is always merely a means; the ultimate goal of education remains to cultivate a “complete and rich artistic personality.” When the virtual and the real reach a perfect harmony in the symphony of education, people can truly play a new chapter in music education. This process will also contribute to the in-depth advancement of the modernization of university music education.

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Research on the Alignment Strategies Between the Practical Teaching System of Tourism Management Major and Enterprise Needs

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Abstract: With the transformation, upgrading, and high-quality development of China's tourism industry, the demand for tourism management professionals in the enterprise market has undergone profound changes. At present, the practical teaching of tourism management majors in colleges and universities faces various problems in terms of talent training objectives, teaching processes, and evaluation mechanisms, resulting in a significant mismatch between talent training and the actual needs of enterprises. Against this background, this paper conducts research by identifying the new standards of talent demand in tourism enterprises, systematically analyzing the practical dilemmas faced by the practical teaching of tourism management majors. Furthermore, the paper proposes alignment strategies between the practical teaching system of tourism management majors and enterprise needs from the dimensions of curriculum system reconstruction, teaching staff development, practical platform construction, and evaluation mechanism innovation. These strategies aim to effectively improve the pertinence and adaptability of talent training and serve the development of the regional tourism economy.

Keywords: Tourism management; Practical teaching; Enterprise needs; Industry-education integration; Talent training

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1. Introduction

Tourism is one of the pillar industries of the modern service sector, and it is gradually shifting from resource-driven to talent and innovation-driven. Against the background of the new era, themes such as smart tourism, cultural and tourism integration, and personalized customization have become new formats for the development of the tourism industry. This requires the training of tourism management talents to adjust their knowledge structure, improve practical capabilities, and vocational literacy training methods to meet market demands. However, the current practical teaching system of tourism management majors is obviously lagging behind the changes in the tourism industry. Therefore, exploring how to promote the alignment between the practical teaching system of tourism management majors and enterprise needs has become one of the key issues of

current concern.

2. Diagnosis of talent demand standards in tourism management enterprises

2.1. Compound knowledge structure: from “single skill” to “multidimensional knowledge”

Against the backdrop of the new era, the talent demand of tourism enterprises has transcended the traditional standards of single skills such as tour guiding and hotel services, gradually shifting toward talents with compound knowledge backgrounds. Specifically, the current enterprise demand for tourism management professionals’ capabilities can be analyzed from three perspectives. First, digital operation capabilities. Enterprises require talents proficient in digital skills such as big data analysis, new media marketing, online tourism platform management, and smart scenic area system application to support the digital transformation and upgrading of tourism enterprises and services ^[1]. Second, knowledge of cultural and tourism integration. In the context of integrated cultural and tourism development, enterprises need talents with profound historical and cultural literacy, artistic aesthetic ability, and folklore knowledge to provide tourists with in-depth, connotative, and interesting cultural interpretations and service experiences ^[2]. Third, foundational knowledge of management and economics. Enterprises seek employees with basic knowledge of project management, financial management, marketing, and consumer behavior to cultivate reserve talents for management positions.

2.2. High-Level practical abilities: From “operational proficiency” to “problem-solving”

In the process of digital transformation, tourism enterprises’ requirements for talent have gradually evolved from “hands-on operation” to “critical thinking” to address various work-related issues. First, crisis management and emergency response capabilities. In the internet era, tourism enterprises need to handle unexpected incidents, thus requiring talents who can calmly, standardizedly, and efficiently resolve public opinion risks such as customer complaints, safety accidents, and public health emergencies ^[3]. Second, product innovation and project planning capabilities. As competition in the tourism industry intensifies, traditional tourism design ideas can no longer attract tourists’ attention and preference. Therefore, enterprises need talents capable of participating in or leading tourism route design, planning cultural and tourism activities, and developing research travel products ^[4]. Third, customer relationship management and precision service capabilities. Supported by big data systems and online platforms, tourism enterprises must strengthen their customer relationship management and precision service capabilities, which requires employees to be skilled in maintaining high-end customers, handling complaints, and providing personalized and customized services.

2.3. Comprehensive professional literacy: From “professional identity” to “internal motivation”

Knowledge and skills can be acquired through education and training, but sound professional literacy is the cornerstone of a talent’s long-term development prospects. Tourism enterprises also attach great importance to employees’ professional literacy, which mainly includes three dimensions: First, service awareness and professionalism. Employees are required to maintain correct value recognition in service work, demonstrating patience, carefulness, and a sense of responsibility ^[5]. Second, communication, coordination, and teamwork abilities. Employees must be able to communicate and collaborate with other departments, colleagues of different personalities, and customers. Third, learning adaptability and pressure resistance. Given the tourism

industry's strong seasonality and rapidly changing trends, employees need to maintain enthusiasm for continuous learning and possess the psychological resilience to adapt to high-intensity work.

3. Analysis of dilemmas in the practical teaching of the tourism management major

3.1. Disconnection between practical teaching objectives and enterprise needs

First, vague goal positioning. The existing practical teaching programs for tourism management majors mainly focus on “verifying theories” and “skill operations”, lacking comprehensive and systematic practical projects. As a result, they fail to simultaneously enhance students’ professional capabilities, innovative thinking, and ability to solve complex problems ^[6].

Second, severe homogenization. The teaching plans for tourism management talent cultivation in various colleges and universities show a tendency towards convergence. They have not carried out differentiated design and precise positioning based on local tourism projects, characteristics of the tourism economy, and other specific factors.

3.2. Disconnection between practical teaching processes and industrial dynamics

First, outdated teaching content. Textbooks and cases related to tourism management majors are updated slowly, failing to introduce new technologies, standards, and formats in the industry into courses in a timely manner, such as low-carbon travel design, red tourism routes, metaverse travel, and VR travel ^[7].

Second, simplistic teaching methods. In practical teaching of tourism management majors, schools mainly adopt methods such as on-campus training and simulation operations. Large-scale and extensive training projects in real work scenarios are lacking, as are project-based and inquiry-based teaching activities.

Third, fragmented practical links. Existing activities, such as curriculum experiments, professional internships, and graduation internships in tourism management majors, lack systematic connection and integration, failing to achieve the effect of gradual talent cultivation.

3.3. Weak guarantee and support system for practical teaching

First, a shortage of “dual-qualification” teachers. Most teachers of tourism management majors start teaching directly after graduating from similar majors, lacking practical work experience in tourism enterprises. They have insufficient understanding of frontline tourism positions, talent recruitment, and practical content, and thus lack “dual-qualification” literacy ^[8].

Second, insufficient depth of school-enterprise cooperation. Cooperation between schools and enterprises remains superficial, mainly involving enterprises providing internship opportunities for students. Enterprises are rarely involved in in-depth talent cultivation activities such as curriculum development, textbook compilation, and training base construction. A benefit-sharing mechanism has not been established.

Third, lagging construction of practical platforms. Schools have stagnated in building training bases for tourism management majors. On one hand, they fail to update relevant software and hardware equipment in a timely manner; on the other hand, the simulated working environment differs greatly from the real workplace. In addition, off-campus internship bases also have problems such as unstable work content and irregular management. Some even treat students as cheap labor, losing their due educational significance ^[9].

4. Strategies for aligning the practical teaching system of the tourism management major with enterprise needs

4.1. Reconstructing a modular practical curriculum system integrating “posts, courses, competitions, and certifications”

First, curriculum development is based on systematic work processes. Schools should establish special working groups to conduct in-depth enterprise research, analyze core skills required for typical positions such as travel planners, new media operators, and hotel revenue managers, and then transform their work tasks into learning projects. This will help build a progressive curriculum system consisting of “basic skills module—core position module—comprehensive innovation module”^[10]. For example, schools can jointly develop courses with cooperative enterprises, using loose-leaf textbooks or work manual-style materials to truly reproduce real enterprise cases and provide students with high-quality learning projects.

Second, promoting in-depth integration of “posts, courses, competitions, and certifications.” Schools should integrate and process core job skills, vocational skill competition items, and the content of vocational qualification exams to comprehensively optimize and adjust the existing curriculum system and assessment standards. For instance, the assessment standards of tour guide service competitions and hotel service competitions can be introduced as evaluation requirements for practical teaching; contents of national tour guide qualification exams and customized travel butler certification exams can be integrated into daily teaching activities, so as to achieve the goal of promoting learning through competitions and enhancing teaching through certifications.

Third, introducing project-based learning. Schools should actively establish in-depth cooperation with local scenic spots, travel enterprises, and hotels, and provide students with complete practical projects from research and planning to reporting through real commercial projects. For example, a project task like “designing a marketing plan for a scenic spot during the National Day Golden Week” can be assigned^[11], requiring student teams to collect information through on-site investigations and tourist interviews, and then complete the design, planning, and organization of the report.

4.2. Establishing a faculty development mechanism of “two-way flow and collaborative education”

First, implementing a “dual-qualification” teacher training program. Schools should establish a system for teachers to take temporary positions in enterprises and launch a teacher enterprise mobility workstation project. Tourism management teachers are required to participate in enterprise practices regularly, engaging in management, development, logistics, and other positions, with such experiences included in their performance evaluation. For example, it can be stipulated that teachers must accumulate no less than 6 months of practical experience every five years.

Second, establishing a special appointment system for “industry mentors.” Schools can establish a talent mutual employment mechanism with cooperative enterprises, hiring technical backbones and management personnel from enterprises as part-time industry mentors to undertake educational tasks such as partial course teaching, practical teaching, graduation project guidance, and lectures. For instance, “industry professor” positions can be set up to attract talent with academic titles and favorable treatment, and a stable pool of part-time teachers can be established.

Third, building a school-enterprise teaching and research community. Schools should organize cooperation between in-school teachers and enterprise experts to form teaching and research teams, and achieve benefit

sharing through cooperative research projects, curriculum development, virtual simulation project development, and other activities. For example, schools can regularly hold “school-enterprise salons” with themes such as industry hotspots and teaching difficulties for discussions to realize knowledge sharing ^[12].

4.3. Building a practical teaching platform of “integration of virtual and real, symbiosis and sharing”

First, co-constructing “education-oriented” productive training bases. Schools can adopt the “factory-in-school” model to deepen school-enterprise cooperation, where schools provide venues and educational management, and enterprises offer operational and technical support. This forms a new-type practical teaching platform that not only provides internship environments for students but also generates certain benefits, achieving the goal of co-construction, sharing, and win-win ^[13]. For example, schools can co-establish “teaching hotels” with well-known hotels or cooperate with travel agencies to build “campus tourism service centers”, integrating business entities with teaching venues.

Second, developing smart tourism virtual simulation training centers. Schools should leverage technologies such as VR/AR, big data, and artificial intelligence to actively develop and apply virtual simulation teaching software, thereby realizing simulated training services for smart scenic area management, hotel revenue management, and tourism crisis disposal ^[14]. This compensates for the high costs and risks of real training projects. For instance, schools can apply for national or provincial virtual simulation experimental teaching projects as needed to promote resource opening and sharing.

Third, developing in-depth school-enterprise cooperation alliances. Schools should actively establish a council governance structure, clarify the rights and responsibilities of each cooperative party, set up cooperation development funds, and form a long-term and stable alliance guarantee ^[15]. For example, schools can cooperate with multiple enterprises to build a “tourism vocational education group”, collaboratively formulate talent training programs at the strategic level to achieve professional co-construction and internship co-management.

4.4. Improving the “multi-participation, process-oriented” practical teaching evaluation and feedback mechanism

First, introducing multi-evaluation subjects based on enterprise standards. Schools should change the phenomenon of single evaluation by teachers and involve multiple subjects, such as enterprise mentors, customers, and student team members. For example, a “practical ability e-portfolio” mechanism can be established to systematically record students’ performance and achievements in different links and periods.

Second, implementing process-oriented assessment based on ability evidence. Schools should reform the “one-exam determines the result” model and establish assessment indicators from perspectives such as project reports, plan planning, practical operation processes, and team collaboration.

Third, establishing a closed-loop quality feedback and improvement system. Schools can regularly collect feedback on graduate quality from enterprises and the market through questionnaires, and organize alumni and enterprise forums, using this as the basic basis for revising the practical teaching system.

5. Conclusion

In summary, the precise alignment between the practical teaching system of tourism management majors and enterprise needs is built on concepts, curricula, faculty, platforms, and evaluation. Schools must break away

from traditional school-running models, embrace industrial changes with an open attitude, and thus solve the problem of “disconnection” between talent cultivation and market demand. This will deliver more high-quality, compound, and innovative technical and skilled talents for the high-quality development of China’s tourism industry.

Disclosure statement

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Innovative Models of Educational Cooperation Between China and Countries Along the Belt and Road Initiative

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Abstract: As a vital bridge for fostering mutual understanding among people, educational cooperation plays an irreplaceable role in serving national strategies and cultivating globally-oriented talents. While China has made positive strides in educational collaboration with Belt and Road countries, challenges persist, including inadequate coordination of cooperation mechanisms, insufficient innovation in cooperation models, and room for improvement in resource allocation and quality assurance systems. Building upon an analysis of the significance and practical challenges of educational cooperation, this paper proposes pathways for advancing model innovation through enhancing top-level design, innovating cooperation models, and optimizing resource allocation. These recommendations aim to provide insights for deepening educational collaboration between China and Belt and Road countries.

Keywords: Belt and Road; Educational cooperation; Model innovation; International student education; International education

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1. Introduction

Since its inception in 2013, the Belt and Road Initiative has evolved into a vital practical platform for building a community with a shared future for mankind. As a key component of the Belt and Road framework, educational cooperation bears the important mission of fostering people-to-people bonds, cultivating globally-minded talent, and promoting exchanges and mutual learning among civilizations. However, amid deepening regional integration and evolving international dynamics, educational cooperation continues to face challenges such as inefficient coordination mechanisms, limited cooperation models, and inadequate quality assurance systems. How to innovate educational cooperation models and build a closer educational community has become an urgent and critical issue. This paper aims to explore innovative pathways for educational cooperation between China and Belt and Road countries within the framework of the initiative, based on an analysis of the value and

challenges of such cooperation. It seeks to provide theoretical references and practical guidance for deepening and solidifying educational collaboration.

2. The significance of educational cooperation between China and Belt and Road countries

2.1. An essential requirement for serving the national strategy and building a community with a shared future for mankind

Educational cooperation has become a vital pillar of the Belt and Road Initiative, holding significant importance for serving China's overall diplomatic strategy and building a community with a shared future for mankind. From a national strategic perspective, the Belt and Road Initiative requires a large number of knowledgeable, internationally oriented talents who possess technical expertise, language proficiency, and cultural awareness. Through joint training programs, mutual recognition of academic qualifications, and faculty-student exchanges, educational cooperation delivers numerous high-caliber professionals to countries along the routes. This effectively supports the development of key areas such as infrastructure connectivity and economic-trade investment cooperation. From the perspective of building a community with a shared future for mankind, education inherently possesses the unique capacity to transcend borders and connect hearts. Through educational exchanges, young scholars from different nations deepen mutual understanding while pursuing knowledge, resolve misunderstandings and prejudices through civilizational dialogue, and forge consensus on development through win-win cooperation^[1]. This fosters a solid foundation of public support and social roots for establishing a new type of international relations characterized by mutual respect, fairness, justice, and win-win cooperation.

2.2. Promoting shared educational resources and regional educational synergy

Educational development levels vary significantly among Belt and Road countries, with uneven distribution of educational resources. Deepening educational cooperation can break down resource barriers, enabling the rational circulation and allocation of high-quality educational resources within the region, thereby advancing coordinated regional educational development. On one hand, China provides educational assistance to developing countries along the Belt and Road through government scholarships, educational facility construction aid, and teacher volunteer programs. This helps improve their educational conditions and quality while introducing advanced educational concepts, curricula, and teaching methods to support the modernization of education in these countries. On the other hand, countries along the Belt and Road complement each other's strengths in educational cooperation^[2]. China's higher education system holds advantages in scale and discipline development, while some partner nations possess distinctive features in vocational education and elite education.

2.3. Cultivating global talent and fostering people-to-people connections through cultural exchange

Educational cooperation plays an irreplaceable role in nurturing globally-minded talent with cross-cultural communication skills, promoting people-to-people bonds, and facilitating civilizational exchanges. Through student exchange programs, young people from Belt and Road countries can venture beyond their borders to pursue advanced studies abroad, experience diverse cultures, broaden their horizons, and emerge as a new

generation of talent with international competence. International student education not only imparts knowledge and skills but also fosters cultural exchange. Foreign students studying in China gain insights into Chinese history, cultural development, and governance experiences while learning the Chinese language and characters, becoming friendly ambassadors who amplify China's voice and tell its stories effectively ^[3]. Chinese students studying in Belt and Road countries deepen their understanding of local societies and cultures through firsthand experience, playing a vital role in fostering people-to-people bonds and enhancing bilateral friendship.

3. Current challenges in China-Belt and Road countries educational cooperation

3.1. Insufficient coordination in cooperation mechanisms and policy alignment

Current educational collaboration between China and Belt and Road countries faces significant shortcomings in mechanism construction and policy coordination, hindering deeper cooperation. Multilateral educational cooperation mechanisms remain underdeveloped. While bilateral educational partnerships exist between China and some partner countries, regional and multilateral educational cooperation platforms are scarce. Insufficient coordination in educational policies, planning, and development across regions prevents the formation of a unified regional educational cooperation force. Policy and institutional alignment are inefficient. Significant disparities exist among Belt and Road countries in academic credential recognition standards, educational quality evaluation systems, and teacher qualification requirements ^[4]. Loose policy integration increases the institutional costs of educational cooperation.

3.2. Insufficient innovation and sustainability in cooperation models

While China has adopted diverse forms of educational cooperation with Belt and Road countries, notable shortcomings persist in model innovation and long-term sustainability. Cooperation models remain relatively traditional and limited. Current educational collaboration is largely confined to conventional approaches such as student exchanges, teacher visits, and joint school establishment, with limited exploration in emerging fields like digital education, online learning, and distance training. Faced with educational transformations driven by rapid information technology advancements, there has been insufficient utilization of new technologies—including the internet, big data, and artificial intelligence—to expand cooperation opportunities and innovate collaboration methods. Some cooperative projects remain at a superficial exchange level, lacking substantive, deeply integrated cooperation, making it difficult to achieve lasting impact ^[5]. Sustainability issues arise as some educational cooperation projects rely excessively on government promotion and funding support, lacking market-oriented operational mechanisms and insufficient participation from social forces. These projects become vulnerable to discontinuation when policies change or funding ceases.

3.3. Educational resource allocation and quality assurance systems require improvement

High-quality educational resources, their rational allocation, and scientific quality assurance are essential for the healthy development of educational cooperation. However, both aspects face challenges. Resource distribution reveals significant imbalances in educational cooperation. Most high-quality educational resources are concentrated in economically developed regions and key universities, leaving vast central and western regions and ordinary institutions with few opportunities to participate in educational cooperation. Consequently, more students cannot benefit. Furthermore, the design of educational cooperation projects often fails to align with the actual needs of countries along the Belt and Road routes. Some projects experience “cultural incompatibility”,

resulting in poor returns on resource investments. The development of teaching staff has been relatively slow, with a relative shortage of high-quality educators possessing international educational backgrounds and cross-cultural communication skills. This shortage impacts the quality and level of educational cooperation ^[6].

4. Innovative pathways for educational cooperation between China and countries along the Belt and Road Initiative

4.1. Improving top-level design and establishing a multi-level educational cooperation mechanism system

To drive innovation in educational cooperation models, it is essential to strengthen top-level design and establish a multi-tiered, multidimensional educational cooperation mechanism system. This involves improving intergovernmental educational cooperation mechanisms, fully leveraging multilateral platforms such as the Belt and Road Forum for International Cooperation, the Shanghai Cooperation Organization, and the China-ASEAN Education Exchange Week. Efforts should focus on establishing regular consultation systems among education ministries of participating countries, enhancing dialogue on educational policies, aligning strategic planning, and conducting research to address major challenges arising in educational cooperation. Establish an information-sharing platform for educational cooperation to promptly publish national education policies, cooperative projects, and study abroad opportunities, ensuring unimpeded information exchange channels ^[7]. Create regional educational cooperation organizations, such as the Belt and Road Education Cooperation Alliance, to coordinate regional educational cooperation affairs and enhance the organizational level of such collaboration.

4.2. Innovate cooperation models and expand diverse implementation pathways for educational collaboration

Innovation serves as the driving force for educational cooperation development. Grounded in the realities of the new era and the actual conditions of countries along the Belt and Road, diverse and distinctive educational partnerships should be explored. Innovate joint education models to promote in-depth collaboration between Chinese universities and institutions in partner countries. This includes establishing specialized colleges, joint research centers, and collaborative innovation hubs, alongside implementing credit recognition, joint degree programs, or cooperative training initiatives. Promote the “Chinese Language + Vocational Skills” talent cultivation model, integrating Chinese language instruction with professional skills training to develop versatile professionals proficient in both Chinese and specialized competencies. Advance digital education cooperation by seizing the trend of educational digital transformation, focusing on building online education platforms, and intensifying efforts in developing high-quality digital educational resources and promoting new teaching methods such as MOOCs and micro-courses. This will enable teachers and students in countries along the Belt and Road to access China’s premium educational resources ^[8].

4.3. Optimize resource allocation to enhance quality assurance in educational cooperation

Improving the quality of educational cooperation is central to its sustainable development. This requires optimizing the distribution of educational resources and refining quality assurance systems to achieve high-quality development in educational collaboration. On one hand, strengthen resource allocation by increasing the number of government scholarships and optimizing the distribution of student sources by country/region and major. Prioritize developing countries along the Belt and Road and disciplines critical to Belt and

Road initiatives. Strengthen faculty development by implementing overseas training programs for teachers, dispatching key educators for academic exchanges at universities along the Belt and Road to enhance their international teaching capabilities, and recruiting high-level overseas talent to bolster the international education faculty^[9]. On the other hand, improve the quality assurance system by establishing quality standards for educational cooperation projects, defining requirements for institutional positioning, educational objectives, curriculum design, faculty allocation, and teaching management to standardize educational practices. Establish a third-party quality assessment mechanism by commissioning independent institutions to evaluate cooperative programs and the quality of international student education. Make assessment results publicly available to ensure accountability and oversight^[10].

5. Summary

The Belt and Road Initiative has opened up broad prospects for educational cooperation between China and countries along the routes. Deepening educational collaboration and innovating cooperation models are not only crucial measures to serve national strategies but also intrinsic requirements for building a community with a shared future for mankind. People must fully leverage education's unique role in fostering people-to-people bonds and promoting mutual learning among civilizations, making educational cooperation a shining emblem of Belt and Road development. At this new historical juncture, China stands ready to join hands with countries along the Belt and Road. With educational cooperation as the bond, talent cultivation as the foundation, and mutual benefit as the goal, people will jointly compose a new chapter in Belt and Road educational collaboration, contributing educational strength to building a community with a shared future for mankind and a better world.

Disclosure statement

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Application of OBE-Oriented Blended Teaching in Ideological and Political Education of Basic Medical Courses

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Abstract: Ideological and political education in courses is an important manifestation of implementing the fundamental task of fostering virtue through education. Basic medical courses serve as the professional foundation for cultivating high-quality medical, pharmaceutical, and nursing talents. Online-offline blended teaching emphasizes students' learning autonomy, while OBE-oriented teaching focuses on student-centeredness and student learning outcomes. Based on the research on the application of OBE-oriented blended teaching in ideological and political education of basic medical courses, this paper improves the curriculum system of ideological and political education in basic medical courses from three aspects: teaching objectives, teaching design and implementation, and teaching assessment and evaluation system, so as to provide a reference for the teaching reform of basic medical courses.

Keywords: OBE concept; Blended teaching; Basic medicine; Ideological and political education in courses

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1. Background of OBE-oriented ideological and political education in basic medical courses

1.1. Concept of OBE

Outcome-based education (OBE) is an educational model centered on students' final learning outcomes. This concept emphasizes that the design and implementation of education should focus on the abilities and qualities that students can achieve after completing their studies, and prioritize measurable learning outcomes over the coverage of traditional teaching content. In basic medical education, the OBE concept helps transform abstract professional literacy and ethical requirements into specific behavioral indicators, making curriculum objectives more concrete and operable ^[1]. Guided by the OBE concept, teachers can incorporate value guidance objectives

into the learning outcome system at the initial stage of curriculum design, thereby realizing the synchronous development of professional knowledge imparting and the goal of fostering virtue through education. This concept promotes the transformation of teaching from “teacher-centeredness” to “student-centeredness”, strengthens students’ dominant position, enhances their autonomous learning ability and social responsibility, and provides a systematic guarantee for the training of basic medical talents.

1.2. Connotation of ideological and political education in basic medical courses

As the starting point of medical students’ professional learning, basic medical courses not only undertake the important task of imparting basic medical knowledge but also have unique advantages in carrying out ideological and political education ^[2]. By integrating ideological and political education into the teaching process of basic medicine, students can be guided to establish a correct world outlook, outlook on life, and values while acquiring knowledge. In courses such as Histology and Embryology, Physiology, and Pathology, teachers can combine China’s medical development achievements, the dedication of researchers, and typical cases in major public health events to help students understand the social responsibility and historical mission of medical work. This enables students to enhance national identity, national pride, and social responsibility while mastering professional knowledge, and strengthens the professional belief of “health entrusted, life entrusted.”

The cultivation of medical humanistic quality runs through the whole process of basic medical education, emphasizing the shaping of students’ empathy, communication skills, professional ethics, and service awareness ^[3]. In anatomy teaching, respecting the behavior of body donors is itself a vivid humanistic lesson. Teachers guide students to experience the dignity of life and the warmth of medicine by holding tribute ceremonies and writing gratitude letters. In the use of experimental animals, standardized operation and humane treatment are emphasized to help students form basic reverence for life. Famous doctors’ deeds, medical historical facts, and patient stories are interspersed in classes, allowing students to understand that medicine is not only a science but also an art of care from multiple dimensions.

Bioethics education is an indispensable part of ideological and political education in basic medical courses, involving ethical discussions on cutting-edge issues such as gene editing, organ transplantation, human experimentation, and data privacy ^[4]. CRISPR technology cases are introduced in courses such as Biochemistry and Molecular Biology to guide students to think about the moral boundaries behind scientific and technological progress; in Immunology teaching, the protection of the rights and interests of subjects in vaccine research and development is discussed to cultivate students’ critical thinking and ethical judgment ability. Through teaching activities such as situational simulation, group debate, and case analysis, students are encouraged to actively participate in the ethical decision-making process, understanding that medical behaviors must not only meet technical standards but also stand the test of ethical scrutiny.

2. Analysis of the current situation of ideological and political education in basic medical courses

The traditional teaching model still dominates, with teachers mostly taking professional knowledge imparting as the core task, lacking systematic design and proactive awareness of integrating ideological and political education ^[5]. Ideological and political education in courses is often simplified to interspersed cases or slogan-style guidance, failing to deeply integrate with disciplinary content, resulting in rigid and superficial ideological

and political elements. Some teachers have misunderstandings about ideological and political education in courses, regarding it as an additional burden, lacking internal motivation, and perfunctorily dealing with it in teaching design, which affects the overall implementation effect.

The setting of teaching objectives is vague, lacking measurable indicators for talent cultivation outcomes. Most courses do not clearly define the specific goals that students should achieve in terms of values, professional literacy, and social responsibility, leading to a lack of direction and pertinence in the process of ideological and political education. Teaching content is disconnected from ideological and political goals, and there is a lack of logical connection between knowledge points and value guidance, making it difficult for students to naturally form value identification in knowledge learning. The update of ideological and political materials in textbooks and teaching resources lags behind, failing to respond to the ideological characteristics and practical concerns of medical students in the new era, which weakens the appeal and persuasion of education ^[6].

Teaching methods are single, relying on classroom lectures, and lacking interactive and situational design. Students find it difficult to generate emotional resonance in passive acceptance, hindering the process of value internalization. The application of modern information technology is insufficient, and the construction of online resources is weak, which cannot support personalized and independent ideological and political learning needs. Although attempts have been made at blended teaching, most remain at the level of “watching videos online + listening to lectures offline”, failing to achieve true teaching integration and process reconstruction, and thus are unable to meet the requirements of student-centered learning outcome achievement under the OBE concept.

The evaluation system emphasizes knowledge over literacy, with assessments still focusing on the mastery of professional knowledge, and insufficient attention is paid to students’ ideological growth, ethical judgment ability, humanistic care awareness, and other dimensions. The lack of process evaluation makes it difficult to quantify and provide feedback on ideological and political performance, leading to a lack of basis for teaching improvement. Teachers’ own ideological and political teaching capabilities vary, with a lack of systematic training and support mechanisms. The interdisciplinary collaborative education mechanism has not been established, resulting in insufficient communication between basic medical teachers and ideological and political teachers, and difficulties in resource integration. Institutions have inadequate institutional guarantees, imperfect incentive mechanisms, and incomplete quality monitoring systems for ideological and political education in courses, leading to slow progress in teaching reform.

3. Application practice of OBE-oriented blended teaching in ideological and political education of basic medical courses

3.1. Improve the syllabus and integrate ideological and political education into teaching objectives with student outcomes as the orientation

The improvement of the syllabus requires systematic reconstruction around the final learning outcomes that students can achieve, and the design of course objectives focuses on the knowledge, abilities, and value literacy that students possess after completing the learning process. When integrating ideological and political education objectives into basic medical courses, teachers should emphasize outcome-oriented hierarchical settings to ensure a progressive relationship between objectives at all stages ^[7]. For example, in the early stage of the course, the focus is on cultivating students’ basic professional awareness of respecting life and abiding by medical ethics, guiding students to reverence life and cherish health through content such as Anatomy and Histology and Embryology; in the middle stage, combined with modules such as Pathophysiology and

Microbiology, students' social responsibility and scientific spirit are enhanced, enabling them to understand the social factors and ethical dimensions of the occurrence and development of diseases; in the later stage, the value orientation of teamwork, rigorous scholarship, and humanistic care is deepened in comprehensive case analysis and experimental operations, promoting the transformation of value guidance from cognition to behavior.

The concretization of ideological and political education objectives is reflected in the refined design of teaching units. For example, when explaining the process of cellular metabolism, teachers can embed the research process of scientists overcoming difficulties, allowing students to experience the persistent scientific research attitude. Relying on the natural extension of professional knowledge points, the organic integration of ideological and political education and disciplinary content is realized. Each objective corresponds to observable and assessable student performance indicators, such as participation in classroom discussions, value judgment tendencies in case analysis reports, and professional attitudes reflected in experimental logs. In this way, the entire ideological and political education objective system presents a spiral upward structure, with each cycle raising the cognitive level and practical requirements on the original basis. Through continuous learning experiences, students can gradually establish the sense of mission and responsibility that future medical workers should have ^[8].

3.2. Optimize teaching content and design OBE-oriented blended teaching for ideological and political education

The optimization of teaching content is systematically designed around students' final learning outcomes, highlighting the core principle of "outcome orientation" in the OBE concept. In the pre-class stage, teachers release learning task lists through online platforms, integrating medical humanities, professional ethics, and social responsibility into knowledge points of courses such as Anatomy, Physiology, and Pathology. For example, when explaining human body structure, the dedication spirit of body donors is introduced to guide students to respect life and revere science. Students complete an independent preview by watching customized microlecture videos and reading typical cases, and submit insights in the online discussion area to form initial value cognition. Teachers grasp students' understanding level and ideological dynamics through data analysis, providing precise feedback for classroom teaching ^[9].

The in-class session focuses on interactive inquiry and in-depth inspiration, adopting the flipped classroom model to organize group discussions, case analyses, role-playing, and other activities. Teachers select medical events with ethical controversies or social hot topics as entry points, such as the application boundaries of gene editing technology and the construction of trust in doctor-patient relationships, guiding students to reflect on the moral principles and social responsibilities behind medical behaviors during professional learning. Classroom teaching is no longer limited to knowledge transmission but focuses on thinking guidance and value shaping. Through problem chains, students are driven to actively participate, deepening their understanding of the medical mission. Information technologies such as real-time voting and bullet screen Q&A enhance classroom participation, enabling ideological and political elements to naturally permeate the construction of professional knowledge.

The learning chain is extended after class, expanding learning depth through a combination of online and offline methods. Students complete comprehensive assignments, such as writing commentaries on medical figures' biographies and designing community health education programs, to practice the sense of responsibility as medical professionals in practice. The online platform continues to provide extended resources,

including medical documentaries and reports on the deeds of medical staff on the frontlines of the fight against COVID-19, to strengthen professional identity. Teachers continuously track students' ideological development through homework correction, individual tutoring, and online Q&A, providing positive guidance in a timely manner. The entire teaching process forms a closed loop, with each link serving clear ability objectives and talent cultivation goals, ensuring that students not only master basic knowledge but also possess good professional literacy and social responsibility. Teaching content is no longer a static accumulation of knowledge but a dynamic process of value generation, truly reflecting the student-centered teaching transformation.

3.3. Establish a diversified teaching assessment and evaluation system to comprehensively evaluate ideological and political education

To implement OBE-oriented blended teaching in basic medical courses, it is necessary to construct a corresponding diversified assessment and evaluation system to ensure the achievement of teaching objectives and the reflection of education effectiveness.

Formative evaluation runs through all stages of teaching, dynamically tracking students' learning progress through indicators such as learning participation on online platforms, the quality of discussions, phased test results, and classroom interaction performance. For example, thinking questions related to ideological and political education are set on MOOC or SPOC platforms, guiding students to reflect on medical ethics, professional spirit, and social responsibility. Their answers not only reflect the degree of knowledge understanding but also show the trajectory of value development. Summative evaluation, on the other hand, assesses students' mastery of core knowledge points and their comprehensive application abilities through final examinations, comprehensive case analysis reports, or project presentations^[10].

Online and offline evaluation methods complement each other. Online platforms support the automatic collection of learning behavior data, realizing precise management of process records; offline evaluation focuses on emotional and attitudinal performance in face-to-face interactions, such as the sense of responsibility demonstrated in group reports and the rigorous style reflected in experimental courses. This multi-dimensional data collection provides an objective basis for the effective integration of ideological and political elements.

Comprehensive evaluation of ideological and political education is embedded in the entire assessment system, with special moral education observation points established to transform ideological and political goals, such as medical ethics, scientific integrity, and family and country feelings, into specific evaluation indicators. Students' value judgments, sense of social responsibility, and professional identity demonstrated in various tasks are included in the final evaluation, making ideological and political education no longer an additional link but a core component inherent in the entire teaching process. The evaluation results are not only used to determine academic performance but also provide feedback for subsequent teaching improvement, promoting the continuous improvement of teaching quality.

4. Conclusion

In summary, the application of OBE-oriented blended teaching in ideological and political education of basic medical courses fully reflects the student-centered and learning outcome-oriented teaching philosophy, emphasizing students' dominant position and achieving the goal of cultivating high-quality medical, pharmaceutical, and nursing talents. On the one hand, online-offline blended teaching improves students'

autonomous learning ability; on the other hand, ideological and political education shapes students' world outlook, outlook on life, and values. The integration of ideological and political education and blended teaching realizes knowledge imparting, value guidance, and ability enhancement. By improving the syllabus to integrate ideological and political education into teaching objectives with student outcomes as the orientation, optimizing teaching content to explore ideological and political elements in depth, designing OBE-oriented blended teaching for ideological and political education, and establishing a diversified teaching assessment and evaluation system to comprehensively evaluate ideological and political education, this paper conducts optimization reforms on ideological and political education in basic medical courses, providing new ideas for the teaching reform of basic medical courses.

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Exploration of the Cultivation Path for Intercultural Communication Competence of Hotel Management Talents with International Perspectives

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Abstract: With the acceleration of globalization, the global layout of hotel groups has continued to deepen, leading to an increasingly urgent demand for hotel management talents with international perspectives and intercultural communication competence. Currently, in the talent training of hotel management majors in China, there are problems such as an imperfect intercultural curriculum system, traditional and single teaching methods, a disconnection between practical links and international scenarios, insufficient intercultural experience and competence of teachers, and an incomplete evaluation system. These issues result in graduates struggling to meet the work requirements of the international hotel industry. Based on intercultural communication theory and the characteristics of hotel management majors, this paper defines the core dimensions of intercultural communication competence for talents with international perspectives, analyzes the current training status and bottlenecks, and explores the cultivation path from five aspects: curriculum system reconstruction, teaching method innovation, practical platform construction, teacher team development, and evaluation system optimization. The aim is to assist the industry in cultivating high-quality talents that meet international standards.

Keywords: Hotel management major; International perspective; Intercultural communication competence; Cultivation path

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1. Introduction

In the process of globalization, the hotel industry has demonstrated distinct characteristics of “transnational operation and cultural integration”, with an increasing number of international hotel groups expanding their presence in China. Faced with the increasingly complex and diverse overseas source markets, the hotel

industry must attach importance to integrating standardized services with different cultural backgrounds to provide personalized and high-quality services for guests. Excellent hotel employees should not only accumulate sufficient intercultural knowledge but also develop sensitive intercultural communication awareness and effective intercultural communication competence. In the process of interacting with guests from different cultural backgrounds, they can provide appropriate and efficient hotel services; meanwhile, when communicating with foreign employees, both parties can feel understanding, tolerance, and respect ^[1]. However, graduates of hotel management majors in China often encounter communication misunderstandings when responding to the needs of multicultural customer groups and collaborating with foreign colleagues. This highlights the lag in the cultivation of intercultural communication competence in China's hotel management education, making teaching reform imperative.

2. Definition of intercultural communication competence for hotel management talents with international perspectives

An international perspective requires individuals to proactively acquire information about countries around the world, examine and view global development and national conditions from an objective perspective through comparisons between domestic and international contexts, and transform the world with such thinking ^[2]. Talents with an international perspective need to possess a global outlook, intercultural communication skills, and the ability to handle international affairs. The operational characteristics of the hotel industry demand that hotel management talents must have an international perspective to cope with complex situations in international reception and business interactions. Intercultural communication competence refers to the ability to communicate appropriately and effectively with people who hold different emotional, cognitive, and behavioral orientations toward the world, and its core dimensions mainly include the following four categories ^[3].

2.1. Intercultural cognitive competence

As the foundation of intercultural communication, intercultural cognitive competence involves the understanding, cognition, and respect for the cultures of source countries, as well as reflection on one's own national culture. Students need to understand values, communication norms, social customs, etc., under different cultural backgrounds, thereby developing intercultural awareness and avoiding cultural prejudices and misunderstandings ^[4]. Intercultural cognitive competence includes the cognition of cultural differences and cultural taboos. The former refers to identifying differences between different cultures in dimensions such as individualism/collectivism, power distance, and time perception, helping staff understand others and eliminate misunderstandings; the latter requires understanding the consumption taboos of different cultures to optimize customer service.

2.2. Intercultural language communication competence

Intercultural language communication competence not only includes the mastery of linguistic knowledge, such as vocabulary, grammar, and pronunciation, but also language application abilities, such as linguistic knowledge, discourse analysis skills, and the use of language strategies ^[5]. In hotel work scenarios, intercultural language communication competence consists of basic language ability, contextual adaptation ability, and professional terminology conversion ability. Basic language ability refers to the proficient use of professional foreign languages to handle foreign guest reception scenarios; adaptation ability requires staff to adjust their

language style according to cultural backgrounds—for example, emphasizing euphemistic expressions and non-verbal signals when communicating with guests from high-context cultures, and conveying information directly and clearly to those from low-context cultures; conversion ability refers to translating professional hotel terminology into popular expressions to avoid service deviations.

2.3. Intercultural collaboration and adaptability competence

Intercultural collaboration and adaptability competence is a core requirement for international hotel management positions, encompassing teamwork ability, cultural conflict resolution ability, and cultural adaptability. Collaboration ability requires building trust with foreign colleagues and understanding their work styles; resolution ability refers to quickly identifying and resolving conflicts arising from cultural differences, such as balancing the service rhythm needs of different customer groups; adaptability requires adjusting service strategies according to cultural scenarios—for example, providing independent choice services for Western guests and proactive recommendation services for East Asian guests.

2.4. Intercultural emotional and attitudinal competence

Intercultural emotional and attitudinal competence serves as the “soft support” for intercultural communication. A positive intercultural emotional experience enables individuals to accurately perceive cultural differences, adopt a proactive attitude toward them, enhance communication pleasure, and thereby promote intercultural communication behaviors ^[6]. From the perspective of the time progression of acceptance, intercultural emotional attitudes include four levels: understanding, respect, appreciation, and affection ^[7]. In hotel scenarios, intercultural emotional and attitudinal competence includes the ability to respect and tolerate different cultures, intercultural empathy ability, and cultural confidence.

3. Current status and problems of intercultural communication competence cultivation for hotel management talents with international perspectives

At present, universities offering hotel management majors in China have made numerous explorations in cultivating the intercultural communication competence of talents with international perspectives. In particular, they have strengthened the design of intercultural communication content in English curriculum settings and the development of Chinese and foreign etiquette and cultural content. However, on the whole, there are still the following problems in the cultivation of intercultural communication competence for hotel management talents:

3.1. Problems in the curriculum system

Curriculum design serves as the core carrier for competence cultivation. Currently, universities still face the issue of “prioritizing language over culture and theory over professionalism” in their curriculum setup. Specifically, intercultural content is disconnected from professional studies: most universities only offer foreign language courses, such as “College English” and “Hotel English”, with intercultural elements mostly embedded in these language courses, lacking specialized intercultural communication courses integrated with hotel management, for example, highly professional courses like Case Analysis of Intercultural Services in International Hotels. Additionally, the depth of curriculum content is insufficient: among the few universities that offer Introduction to Intercultural Communication, the course content primarily focuses on intercultural communication in general scenarios, without covering specific applications in hotel settings, making it

difficult for students to translate theory into practical abilities. Furthermore, there is a lack of courses fostering an international perspective: only a small number of universities provide courses such as Development of the International Hotel Industry, leading to students' inadequate understanding of the rules and trends of the international hotel industry and their struggle to develop an international perspective.

3.2. Problems in teaching methods

Currently, universities employ simplistic teaching methods for cultivating hotel management professionals, with instruction primarily relying on traditional lectures supplemented by task-based teaching. This approach emphasizes knowledge input over output, resulting in limited practical opportunities for students, which fails to effectively stimulate their intercultural communication awareness and competence^[8]. Specifically, in intercultural-related courses, teachers adopt the traditional "PPT + case study" lecture model, lacking interactive elements such as role-playing and group discussions. As a result, students passively receive knowledge and struggle to actively reflect on the impact of cultural differences. Although some universities conduct "hotel service simulation" training, most scenarios are designed for "local guests" and do not involve multicultural contexts. Moreover, in practical sessions, simulation tools like multilingual service manuals and cultural taboo reminder cards are absent, making it difficult for students to accumulate hands-on experience. Due to resource constraints, few universities currently utilize "intercultural communication virtual simulation platforms", preventing students from accessing real international hotel work scenarios through digital means.

3.3. Problems in practical sessions

Practice is the testing ground for intercultural communication competence, but there are obvious shortcomings in the practical teaching links of intercultural communication competence cultivation in current universities. Most universities' practical teaching is "locally oriented", with a serious phenomenon of localized internship bases and a scarcity of international practical opportunities. Universities have limited cooperation with international hotel groups, and such cooperation is mostly concentrated on "grassroots service positions", making it difficult for students to access intercultural management roles. Additionally, during internships, students receive little targeted guidance on intercultural communication. Furthermore, many universities offer relatively few programs, such as "international exchange students" and "short-term overseas studies", resulting in students' lack of "immersive" intercultural experiences and difficulty in truly understanding the necessity and key points of intercultural communication.

3.4. Problems in the teaching staff

Teachers are the key to ensuring the quality of talent cultivation, yet the teaching staff of hotel management majors in Chinese universities currently face prominent issues of "insufficient intercultural experience and lack of industry practice." Most professional teachers have no overseas study or work experience, resulting in an inadequate understanding of the cultural scenarios and management models in the international hotel industry, which makes it difficult for them to integrate real intercultural cases into their teaching. Additionally, universities provide few training programs for teachers on intercultural communication competence and offer limited opportunities for inspections and studies in international hotels, leading to slow improvement in teachers' intercultural teaching capabilities.

4. Cultivation paths for intercultural communication competence of hotel management talents with international perspectives

In response to the aforementioned bottlenecks, combined with intercultural communication theory and the practical needs of the hotel industry, this paper constructs a systematic cultivation path from four dimensions: “curriculum, teaching, practice, and teaching staff.”

4.1. Reconstruct the curriculum system

Universities should vigorously promote the development of intercultural courses, offering programs covering the cultures, histories, social systems, and values of various countries. These courses aim to foster students’ ability to understand and tolerate diverse cultures, and enhance their intercultural communication and collaboration literacy^[9]. Adhering to the principle of “integrating professionalism and covering competencies”, universities should deeply integrate intercultural content with hotel management professional courses to build a three-tier intercultural curriculum module: “foundation-profession-expansion.”

In the first year, foundational courses such as Introduction to Intercultural Communication in Hotels, Chinese and Foreign Cultures and Etiquette, and International Hotel English (Listening and Speaking) are offered to impart intercultural communication theories, hotel scenario etiquette, and professional English dialogue, cultivating students’ intercultural cognition and basic language skills.

In the second and third years, professional courses including Case Analysis of Intercultural Services in International Hotels and International Hotel Operation Standards are provided. These courses cover international hotel service cases (e.g., resolving cultural conflicts), intercultural customer complaint handling, and the application of ISO service standards, developing students’ intercultural collaboration and professional communication capabilities.

In the fourth year, expansion courses such as Management Models of Global Hotel Groups, Intercultural Leadership in Hotels, and Laws and Regulations of the International Hotel Industry can be set up. They teach content related to the intercultural management experience of groups, transnational hotel team management, and hotel industry policies in different countries, expanding students’ international perspectives and enhancing their intercultural management abilities.

4.2. Innovate Teaching Methods

Teachers of hotel management majors should break through the traditional lecture-based model and adopt “scenario-based and interactive” teaching methods to stimulate students’ active practice, enabling them to enhance their abilities through “simulation-experience-reflection.” For example, real cases from international hotels can be selected, which present intercultural communication scenarios that students may encounter in their future hotel work. When students realize that such scenarios they might face later could bring embarrassment, or even misunderstandings and conflicts, they will take the initiative to consider solutions and explore the causes of the problems, while urgently wanting to know the optimal solutions, thereby stimulating their learning enthusiasm^[10]. In addition, schools can use on-campus hotel training centers to build “international scenarios” and adopt situational simulation teaching, where students play roles such as “waiters/guests/foreign colleagues” to simulate scenarios like “receiving European and American business guests”, “handling the dietary needs of Muslim guests”, and “handing over shifts with foreign colleagues”, with teachers providing on-site comments; introduce “intercultural communication virtual simulation platforms” that allow students

to experience different cultural scenarios through VR equipment, with the system automatically feeding back problems in communication; and launch “online joint projects” with foreign universities, where students from different countries work in groups to complete “transnational hotel service scheme design” and improve their intercultural communication abilities through online collaboration.

4.3. Build practical platforms

Schools need to construct a three-level practical system of “on-campus, off-campus, and international”: on campus, introduce successful overseas teaching systems and hotel management systems, optimize the local internationalization software environment for hotel management majors, and establish unified domestic and international teaching standards as well as a consistent teaching quality system ^[11]; meanwhile, relying on the on-campus “simulated international hotel”, organize “intercultural service week” activities, invite foreign teachers and international students to act as “guests”, let students provide full-process services under teachers’ whole-process guidance; establish “targeted internship bases” with international hotel groups, arrange “intercultural mentors” during internships to conduct regular intercultural guidance for students; expand the scale of “overseas internship/exchange” programs, establish cooperation with top hotel management universities in countries such as Switzerland and the United States, and provide students with “3–6 months of overseas internships” to help them understand the intercultural management models of international hotels.

4.4. Enhance teachers’ intercultural teaching capabilities

Teachers must enhance their own intercultural awareness; through case analysis, they can help students perceive the differences between diverse cultures, improve their intercultural communication competence, and cultivate students’ abilities to observe, analyze, understand, and evaluate different cultural phenomena from multiple perspectives ^[12]. Schools should broaden teacher recruitment channels to achieve diversification in the teaching staff’s national origins, cultural backgrounds, qualifications, and educational backgrounds. They may recruit teachers with “a master’s degree in overseas hotel management plus more than 5 years of work experience in international hotels”, emphasizing the “comprehensiveness” of the teaching team to form a complementary and sustainable team system ^[13]; encourage teachers to visit renowned foreign universities or research institutions, participate in international academic conferences and cooperative research projects to gain an in-depth understanding of the academic frontier trends in international hotel management and learn advanced teaching models and research methods ^[14]; arrange for teachers to attend “international hotel intercultural management training” and conduct study visits to international hotel groups every year, while supporting teachers to pursue overseas further studies for degrees related to hotel management; invite foreign managers from international hotel groups to serve as “visiting professors” who regularly give lectures and guide students’ practical projects, thereby enhancing students’ intercultural communication sensitivity and self-confidence ^[15].

5. Conclusions and prospects

Combined with the needs of the globalized hotel industry, this paper defines the four core dimensions of intercultural communication competence for hotel management talents with international perspectives, points out the five major problems in the cultivation of such competence, and proposes a five-dimensional cultivation path. Through the closed loop of “theory-practice-evaluation”, students’ abilities are improved to meet industry

demands. In the future, further exploration can be made into the application of digital technologies such as AI virtual assistants in the teaching of intercultural communication competence. In addition, research can be carried out from the perspective of “the international communication of Chinese hotel culture” to explore the cultivation path of compound talents who “understand international rules and promote Chinese culture.”

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Developing a Framework for AI-Assisted Values Education in the Batangas, Philippines Context

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Abstract: The growing presence of Artificial Intelligence (AI) in educational practice presented profound opportunities and ethical questions for teachers of values education in the Philippines, particularly in Batangas Province. AI technologies reshaped learning processes, assessment, and pedagogy, yet their integration into values formation remained under-conceptualized. This paper developed a framework for AI-assisted values education that was responsive to the said province's context. It synthesized theories of moral development, character formation, and digital ethics, and examined Batangas cultural values and policy directions under the Department of Education (DepEd). Drawing upon global research on AI in education and the national movement toward ethical and responsible AI, the study proposed a five-component conceptual model grounded in cultural alignment, teacher competence, ethical AI design, pedagogical innovation, and values assessment. The framework highlighted the indispensable role of teachers as moral agents and cultural mediators, ensuring that AI amplified humanistic learning rather than replacing it. Ultimately, the paper argued that a contextualized model of AI-assisted values education could strengthen moral formation, civic responsibility, and digital citizenship among Filipino learners in the emerging AI-driven society.

Keywords: Artificial intelligence; Values education; Ethical pedagogy; Digital citizenship; Moral development

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1. Introduction

The emergence of Artificial Intelligence as a transformative force across disciplines has redefined the landscape of education worldwide. In the Philippines, particularly in Batangas Province, AI's integration into classrooms is advancing rapidly through partnerships between the Department of Education (DepEd) and technology providers, promoting innovation and efficiency in teaching and learning. The establishment of the Education Center for AI Research (E-CAIR) in 2025 symbolizes the country's commitment to exploring AI's pedagogical potential^[1]. While this movement has focused mainly on cognitive and technical aspects of learning, its

implications for moral and character development—core concerns of values education—remain insufficiently explored.

Values education, known locally as *Edukasyon sa Pagpapakatao* (EsP), is a cornerstone of the K-12 Basic Education Curriculum. It seeks to form learners who are *maka-Diyos*, *maka-tao*, *maka-kalikasan*, and *maka-bansa*—God-fearing, humane, patriotic, and environmentally responsible individuals. These four core values, institutionalized in the Philippine Constitution and the national curriculum, reflect the moral vision of education as both personal and social transformation. Traditionally, values formation has been achieved through teacher modeling, dialogue, reflection, and community engagement. However, the arrival of AI technologies in schools is challenging educators to rethink how these values can be taught, reinforced, and assessed in increasingly digital environments.

The challenge is twofold. On one hand, AI offers powerful tools for personalized learning, adaptive assessment, and interactive engagement that can enrich moral inquiry and reflection. On the other hand, it introduces ethical dilemmas—bias, privacy, surveillance, misinformation, and the risk of dehumanization—that may compromise the very goals of values education. The teacher’s moral agency, once at the center of character formation, now shares space with algorithms capable of recommending content, grading assignments, or simulating dialogue. Without a guiding framework, the integration of AI into values education could lead to fragmented or ethically inconsistent practices.

In the Philippine context, this tension intersects with unique socio-cultural dynamics. Filipino values such as *pakikipagkapwa-tao* (shared humanity), *bayanihan* (community cooperation), and *utang na loob* (debt of gratitude) define social relationships and moral expectations. Any framework for AI-assisted values education must therefore resonate with these cultural orientations while aligning with national policy and global standards for ethical AI. The DepEd’s recent advocacy for “responsible and ethical AI use” emphasizes that technology should empower rather than replace teachers, underscoring that human relationships remain central to education ^[2].

This paper develops a conceptual framework for AI-assisted values education grounded in Philippine realities. It aims to answer three guiding questions: first, how can AI be ethically and effectively integrated into the teaching of values education; second, what competencies must teachers possess to mediate technology and morality; and third, what model can guide policymakers, educators, and developers in creating AI systems that support rather than erode humanistic education.

The discussion proceeds in several sections. The literature review surveys theoretical foundations of values education and moral development, research on AI in education, and existing frameworks on ethical AI. The conceptual analysis then articulates a proposed model composed of interrelated components addressing cultural, pedagogical, ethical, and institutional dimensions. Subsequent sections discuss implications for teachers, policymakers, and technology designers, followed by recommendations for research, policy, and implementation.

The significance of this study lies in its attempt to bridge moral education and digital innovation. As schools move toward AI-enabled classrooms, particularly in Batangas Province, Filipino educators face the urgent task of ensuring that technological advancement remains anchored in human values. A culturally grounded, ethically sound, and pedagogically viable framework can guide the integration of AI into EsP and other related subjects, transforming AI from a mere technical aid into a partner in moral formation.

2. Objectives of the study

This study aimed to examine the opportunities and challenges of integrating Artificial Intelligence (AI) into values education in Batangas Province, particularly in the context of *Edukasyon sa Pagpapakatao* (EsP). It sought to synthesize theories of moral development, character formation, and AI ethics to provide a conceptual foundation for AI-assisted moral instruction. The study also analyzed existing literature on AI in education and its implications for values formation within the Philippine context. Building on these insights, it developed a five-component framework that aligned cultural values, teacher competence, ethical AI governance, pedagogical strategies, and assessment systems. Furthermore, the study proposed policy, teacher training, curriculum, and community partnership strategies to support the effective implementation of AI-assisted values education in Batangas schools. It established the humanistic and ethical principles that should guide AI integration, demonstrating how AI could function as a moral collaborator while respecting Filipino cultural and social contexts. Additionally, the study identified potential risks and ethical considerations in AI-assisted values education and outlined measures to mitigate them. Ultimately, it highlighted how AI could ethically and culturally enhance moral formation, ensuring that technology supported rather than replaced human-centered pedagogy and promoted lifelong processes of *pagpapakatao* among Filipino learners.

3. Theoretical and conceptual background

Values education encompasses processes of moral reasoning, ethical decision-making, and character formation through which learners internalize principles guiding behavior and relationships. Foundational theories such as Kohlberg's stages of moral development and Bandura's social learning theory emphasize cognitive and behavioral dimensions of moral growth. Character education models highlight virtues like honesty, empathy, and responsibility as learnable dispositions that must be cultivated through modeling, reinforcement, and reflection. In the Philippine curriculum, values education integrates these perspectives through contextual and experiential learning, promoting the development of *kagandahang-asal* (moral goodness) and *pagpapakatao* (humaneness) as lifelong pursuits.

The arrival of AI reconfigures this landscape. AI in education encompasses a wide range of technologies—from intelligent tutoring systems and natural language processing to generative AI that produces text, images, or simulations. Globally, these tools are being used to personalize learning experiences, analyze student performance, and assist teachers in administrative and pedagogical tasks ^[3]. In the Philippines, particularly in Batangas Province, AI adoption is expanding through collaborations with international partners such as Microsoft, whose platforms now support automated feedback, lesson planning, and assessment analytics in many public schools ^[4].

These developments present opportunities for values education. AI-driven simulations can immerse learners in moral dilemmas that foster ethical reflection; adaptive learning systems can tailor values-based discussions to individual developmental levels; sentiment analysis can help teachers gauge student attitudes; and AI-supported journaling can promote self-reflection and empathy. Yet, such innovations must be balanced with an understanding of the risks associated with algorithmic decision-making. AI systems often reproduce the biases of their data sets and may inadvertently privilege certain moral perspectives over others ^[5]. Moreover, overreliance on AI can erode interpersonal relationships, critical thinking, and moral autonomy—the very capacities that values education seeks to strengthen.

The need for ethical frameworks to guide AI use in education has been recognized by international organizations. UNESCO's AI Competency Framework for Teachers underscores not only technical proficiency but also values such as fairness, transparency, and accountability ^[6]. It argues that educators must cultivate digital ethics and a critical understanding of AI's limitations. For the Philippine context, these competencies must be situated within the moral imperatives of the K-12 curriculum and the broader national vision of education as a means of character and nation-building.

Despite emerging literature on AI and ethics, little research specifically addresses how AI can assist in teaching values education. Philippine studies have primarily focused on the technological integration of AI in science, mathematics, and language learning, leaving a gap in understanding its role in moral formation. The absence of a localized framework risks the uncritical importation of foreign models that may not align with Filipino cultural and ethical norms. Therefore, developing a conceptual framework rooted in the Philippines' educational philosophy and moral traditions is both timely and necessary, particularly in Batangas Province.

4. Review of related literature

The landscape of values education in the Philippines has evolved through various curricular reforms and philosophical foundations that emphasize holistic human development. The K-12 curriculum situates values education as a key subject, not only for moral instruction but also for developing socio-emotional and civic competencies necessary for participatory citizenship. The *Edukasyon sa Pagpapakatao (EsP)* curriculum underscores moral discernment, empathy, social responsibility, and respect for human dignity. These aims align with the global frameworks on education for sustainable development and global citizenship, where the formation of ethical awareness and values-based decision-making is integral to achieving inclusive and equitable quality education ^[7].

Filipino scholars such as Jovita Calub and Patricia Licuanan have argued that moral education in the Philippines must balance traditional Filipino virtues with the demands of modern democratic society. Calub emphasized *pakikipagkapwa-tao* as the core of Filipino ethics—a relational virtue that situates morality in communal harmony rather than individual autonomy. This relational framework finds renewed relevance in the era of AI, where interpersonal empathy and community values must counterbalance technological abstraction and algorithmic reasoning. The challenge for educators is to ensure that digital learning environments do not erode, but rather enrich, this relational moral fabric.

AI in education, as reviewed by Holmes et al., encompasses three primary dimensions: learning with AI (as a tool), learning about AI (as content), and learning through AI (as a partner in inquiry) ^[8]. Each of these dimensions has implications for values education. Learning with AI allows teachers to use intelligent systems to facilitate reflective dialogue, simulate moral dilemmas, or assess value-oriented behaviors. Learning about AI, on the other hand, exposes students to ethical debates concerning technology, automation, and human identity—topics that directly intersect with moral education. Finally, learning through AI entails engaging students in co-constructive processes with AI agents, where values such as collaboration, respect, and critical inquiry are exercised in real time.

However, integrating AI into moral education is not without risk. Scholars such as Borenstein and Arkin have warned that AI's increasing autonomy in decision-making raises questions about responsibility, fairness, and accountability ^[9]. In classrooms, AI algorithms that grade moral reasoning essays or recommend ethical

scenarios could inadvertently reproduce biases embedded in their training data. Furthermore, the opacity of many AI systems—often called the “black box problem”—undermines the transparency essential to ethical learning. Without clear explanations of how decisions are made, students may internalize unexamined moral assumptions, thereby weakening their capacity for critical moral judgment.

In the Philippine setting, these concerns intersect with issues of digital divide, resource inequality, and teacher preparedness. The 2025 report of the Department of Education on AI integration revealed that while AI tools were introduced in pilot schools through the Microsoft 365 platform, disparities in infrastructure and digital literacy among teachers limited effective use ^[4]. Many educators expressed anxiety about using AI responsibly, particularly in subjects that involve moral and emotional development. Teachers feared that overreliance on AI could diminish the authenticity of moral instruction, which depends heavily on empathy and interpersonal engagement. This sentiment aligns with the observation of international researchers that moral formation requires human modeling and relational feedback that AI cannot replicate ^[10].

Nevertheless, the potential of AI to assist teachers in reflective and value-laden pedagogy cannot be dismissed. AI’s capacity for personalization can support differentiated moral instruction. For instance, adaptive systems can present age-appropriate ethical dilemmas or social scenarios aligned with students’ cognitive and emotional maturity levels. Similarly, natural language processing tools can help teachers analyze student reflections or feedback for indicators of empathy, moral reasoning, and value internalization. If designed ethically, such systems can complement teachers’ qualitative insights rather than replace them.

UNESCO’s 2024 *AI Competency Framework for Teachers* identified the integration of ethical awareness as a core professional competency ^[6]. Teachers must not only understand how AI functions but also critically reflect on its implications for fairness, accountability, and transparency. This aligns with the DepEd’s call for responsible AI use as a tool for empowerment, emphasizing that educators must remain the “moral compass” of digital learning ^[2]. In this light, developing a framework for AI-assisted values education becomes an act of ethical design—one that ensures technology amplifies, rather than diminishes, the moral purpose of education.

5. Developing the conceptual framework

The proposed framework for AI-assisted values education in the Philippine context emerges from the synthesis of three domains: moral and values education theory, ethical AI governance, and the Philippine educational-cultural landscape. In the context of SDO Batangas and its learners, the framework is structured around five interdependent components: (1) cultural and curricular alignment of values, (2) teacher professional competence and moral agency, (3) ethical AI design and governance, (4) pedagogical integration strategies, and (5) assessment and feedback systems. Together, these components operate within a cycle of continuous reflection and improvement, supported by policy, research, and community collaboration.

The first component—cultural and curricular alignment—recognizes that values education must be rooted in the moral traditions and social realities of Filipino life. Central to this is the affirmation of pakikipagkapwatao, bayanihan, and pagpapakatao as foundational values guiding interpersonal and communal relationships. AI-assisted systems must therefore be designed and used in ways that reflect these cultural orientations. For example, AI applications that support collaborative learning in Batangas classrooms can be programmed to reward collective problem-solving and empathy rather than mere individual achievement. Furthermore, the EsP curriculum’s emphasis on spiritual, moral, and civic dimensions necessitates that AI tools reinforce rather than

fragment the unity of these learning domains. Ethical design requires embedding Philippine core values—faith, respect, responsibility, and care for others—into the logic and content of digital tools ^[11].

The second component emphasizes teacher professional competence and moral agency. Teachers in SDO Batangas schools are not merely users of AI but mediators of its ethical and pedagogical implications. They must possess three types of literacy: technical literacy (understanding how AI tools work and their limitations), ethical literacy (recognizing biases, privacy issues, and moral consequences), and pedagogical literacy (integrating AI into instruction that nurtures reflection, dialogue, and empathy). The teacher remains the central moral exemplar in values education. While AI may simulate conversation or present ethical dilemmas, it lacks the emotional intelligence and authenticity that arise from lived human experience. Hence, professional development programs must include AI ethics training tailored for values education teachers. The framework posits that teachers' ethical judgment anchors the responsible use of AI, ensuring that technological affordances serve human flourishing.

The third component involves ethical AI design and governance. At the institutional level, DepEd and the Schools Division Office (SDO) Batangas must establish clear policies regarding the ethical use of AI. These include principles of transparency, data privacy, consent, accountability, and equity. AI developers should collaborate with educators and cultural experts to ensure that systems are free from discriminatory bias and are culturally relevant. In particular, AI used for moral education in Batangas schools should be explainable and open to scrutiny, enabling teachers and students to understand how conclusions are generated. Governance structures must also protect learner data, as moral reflections often involve sensitive personal insights. Without strong governance, AI's role in values education risks becoming intrusive or manipulative, contradicting the very ethics it seeks to teach ^[12].

The fourth component pertains to pedagogical integration strategies. This involves designing learning experiences where AI functions as a dialogical partner rather than a didactic authority. For instance, teachers in Batangas can employ AI-driven simulations that immerse students in ethical scenarios, prompting discussion on topics such as environmental responsibility, digital citizenship, or social justice. AI tools like virtual mentors or chatbots can guide students through reflective questioning, but teachers must facilitate debriefing sessions where learners process insights collectively. Another pedagogical strategy involves AI-supported journaling systems where students articulate moral reflections that are analyzed for themes of empathy, fairness, or respect. These technological affordances, when guided by teacher intervention, can make values education more interactive and contextually meaningful. The goal is to transform AI from a neutral instrument into a moral collaborator that encourages deeper self-understanding and communal responsibility ^[13].

Finally, the fifth component concerns assessment and feedback systems. Evaluating values education outcomes is inherently complex, as they involve attitudes, emotions, and behaviors rather than easily quantifiable data. The framework suggests a blended approach combining AI-supported analytics with human qualitative judgment. For example, AI can assist in identifying linguistic patterns in student reflections that indicate moral reasoning or emotional maturity, while teachers in Batangas validate and interpret these findings. Feedback should remain dialogical, emphasizing growth and reflection rather than compliance. The assessment process itself must model the values it teaches—fairness, transparency, and respect for individuality. Furthermore, data collected from AI-assisted assessments should be used to inform pedagogical improvement and not as surveillance mechanisms that constrain student expression.

These five components are interconnected and cyclical. Cultural values shape teacher competence

and guide AI design; ethical governance enables responsible pedagogy; and reflective assessment informs continuous improvement. At the center of this model is the human person—both teacher and learner in SDO Batangas schools—whose dignity and agency must remain the ultimate purpose of all technological interventions.

6. Implications for policy and practice

The development of a framework for AI-assisted values education carries significant implications for educational policy, teacher training, curriculum design, and community partnerships in the Schools Division Office (SDO) Batangas and across the Philippines. At the policy level, the integration of AI into moral and character formation necessitates a re-examination of the philosophical foundations of Philippine education. The Education Act of 1982 and the Enhanced Basic Education Act of 2013 both emphasize holistic development anchored in moral and spiritual growth. However, these policies were not conceived with digital technologies and AI in mind. The emergence of AI-driven pedagogies, therefore, requires new regulatory frameworks that preserve ethical standards while fostering innovation. The Department of Education (DepEd) and the Commission on Higher Education (CHED) must establish national guidelines for AI ethics in education, encompassing issues of data protection, algorithmic transparency, and teacher accountability^[14].

A coherent policy should affirm that AI serves as a supportive assistant rather than a moral authority. This distinction is essential to prevent the dehumanization of values education. Policies should also promote human-in-the-loop models, where teachers remain central in interpreting and mediating AI-generated insights. Furthermore, AI adoption must be contextualized to the Philippine socio-economic landscape, ensuring equity across urban and rural schools, including those in Batangas. The Digital Rise Program under DepEd already seeks to modernize learning infrastructure, but explicit inclusion of ethical and values-oriented AI applications would strengthen its humanistic foundation^[15].

At the institutional level, schools in Batangas must establish AI ethics committees that oversee the use of AI tools in instruction and assessment. These committees could include teachers, parents, IT specialists, and community representatives to ensure transparency and accountability. In the context of values education, such committees could evaluate whether AI applications respect students' moral and psychological development. For instance, AI-based sentiment analysis used to assess moral reflections must comply with data privacy standards under the Data Privacy Act of 2012. Schools should also create clear consent procedures informing students how their learning data will be used and stored^[16].

Teacher training is another critical domain. The introduction of AI in values education challenges educators in Batangas to balance technological competence with ethical sensitivity. Pre-service teacher education programs must include courses on AI ethics and digital pedagogy, emphasizing how algorithms can reinforce or undermine human values. Continuous professional development should focus on reflective AI use—encouraging teachers to interrogate the moral assumptions embedded in AI systems. Workshops could involve case studies where teachers analyze AI-generated scenarios and identify potential ethical dilemmas. By equipping teachers to think critically about AI, values education becomes a site of technological discernment rather than passive adoption^[17].

Curriculum design must likewise evolve. Traditional values education lessons often rely on narrative discussions, role-playing, and reflective writing. With AI, these methods can be enhanced through immersive

simulations and adaptive feedback mechanisms. For example, students could interact with AI-driven virtual communities where they navigate moral challenges related to honesty, respect, or social justice. These experiences should be framed within Filipino moral concepts—such as *utang na loob* (debt of gratitude), *hiya* (sense of propriety), and *pakikisama* (fellowship)—to preserve cultural authenticity. Integrating AI into values education thus becomes an act of cultural translation, ensuring that digital tools express Filipino ethical thought rather than merely importing Western models of moral reasoning ^[18].

Community partnerships also play an indispensable role. Values formation does not occur in isolation; it is sustained by the cooperation of families, local governments, and religious institutions. In an AI-assisted framework, these stakeholders in Batangas can participate by co-creating content, validating ethical case studies, and monitoring the moral effects of technology use. For instance, parent-teacher associations can collaborate in setting ethical standards for AI platforms used at home. Faith-based organizations may contribute moral guidance, ensuring that AI applications align with the broader spiritual values that many Filipino families uphold. Such collaborations embody the principle of *bayanihan*—collective effort toward a shared moral goal ^[19].

Furthermore, integrating AI into values education offers an opportunity to cultivate digital citizenship among Filipino learners in Batangas. The increasing exposure of young people to social media, algorithmic content curation, and online misinformation has heightened the need for critical moral discernment in digital spaces. AI-assisted instruction can help students analyze the ethical dimensions of online behavior—such as privacy, respect, and cyber-empathy. For example, AI chatbots can guide learners through ethical decision-making frameworks when encountering hate speech or disinformation online. This aligns with the Digital Citizenship and Responsibility Curriculum currently piloted in Philippine schools, providing a moral compass for navigating AI-driven environments ^[20].

From an administrative perspective, data ethics must be institutionalized in educational management systems in Batangas. AI applications that analyze student behavior or performance can generate powerful insights for school improvement, but they also carry risks of surveillance and dehumanization. Administrators should ensure that data collected from AI-assisted values education remains confidential, anonymized, and used strictly for formative purposes. Transparent communication between schools and families builds trust and reinforces the ethical integrity of the educational system. Moreover, schools should establish grievance mechanisms that allow students to question or appeal AI-generated assessments, thereby modeling fairness and accountability—key tenets of values education itself ^[21].

In higher education, particularly in teacher education institutions serving Batangas, AI-assisted values education provides a platform for research and innovation. Universities can develop prototype models of AI-enhanced moral pedagogy, testing how various technologies—such as natural language processing, sentiment analysis, and virtual reality—affect ethical reflection. Research centers could examine whether AI can reliably detect indicators of empathy or ethical reasoning in student responses, and how these results compare with human evaluation. Such studies would contribute to both AI ethics and educational theory, positioning the Philippines as a regional leader in human-centered AI education ^[22].

At the broader societal level, the adoption of AI in moral formation contributes to national development goals related to social cohesion, digital literacy, and ethical governance. As AI technologies influence employment, governance, and communication, citizens must be equipped with moral frameworks to navigate these shifts. Values education thus becomes not only a school subject but a lifelong foundation for ethical digital citizenship. A robust AI-assisted framework can prepare learners in Batangas to engage critically and

compassionately in an increasingly algorithmic society, reinforcing the constitutional vision of education as a means for moral and spiritual upliftment ^[23].

7. Philosophical and ethical foundations

The philosophical basis for AI-assisted values education must rest on a coherent synthesis of humanism, virtue ethics, and critical technology studies. Humanism asserts that education's primary aim is the cultivation of the whole person—reason, emotion, and moral conscience. Virtue ethics, derived from Aristotelian and Filipino communitarian perspectives, emphasizes character formation through habituation and reflective practice. Critical technology studies challenge educators to interrogate how digital systems shape human values and behaviors. The integration of AI into values education in Batangas schools thus demands a pedagogy that humanizes technology rather than technologizes humanity ^[24].

From a Filipino philosophical standpoint, *Edukasyon sa Pagpapakatao* embodies a form of indigenous virtue ethics. It conceives the moral life as a process of *pagpapakatao*—becoming fully human through relational engagement and moral discernment. AI-assisted instruction in Batangas classrooms must therefore support this process by facilitating reflection and dialogue rather than imposing algorithmic moral judgments. The AI's role should be analogous to that of a *katulong* (helper), assisting learners in understanding their experiences and choices. By situating AI within Filipino moral anthropology, the framework resists technological determinism and upholds human dignity as the axis of moral education ^[25].

Ethically, the framework adheres to four principles: respect for autonomy, beneficence, non-maleficence, and justice. Respect for autonomy requires that learners maintain agency over their moral reflections and data. Beneficence demands that AI systems promote moral growth and psychological well-being. Non-maleficence entails preventing harm by avoiding manipulative or biased AI outputs. Justice requires equitable access to AI resources and safeguards against cultural bias, ensuring that both urban and rural learners in Batangas benefit fairly from AI-assisted values education. These ethical principles, adapted from biomedical and AI ethics traditions, ensure that values education remains aligned with universal human rights while resonating with Filipino communal ethics ^[26].

A major philosophical concern lies in the nature of moral reasoning itself. While AI can simulate ethical dialogue, it lacks intentionality—the conscious moral awareness that underlies authentic virtue. Therefore, AI should never replace human conscience but instead act as a mirror that helps learners recognize their moral inclinations. The teacher's interpretive mediation, especially in Batangas classrooms, bridges the gap between algorithmic feedback and lived moral understanding. In this sense, AI becomes a reflective instrument—an aid to moral consciousness rather than a substitute for it ^[27].

The humanistic dimension also emphasizes the affective domain. Empathy, compassion, and moral sensitivity cannot be fully captured by data analytics, yet they can be nurtured through carefully designed AI interactions. For instance, conversational agents that respond empathetically to students' reflections may model caring communication, prompting learners in Batangas to express emotions more openly. Still, the authenticity of these interactions depends on how teachers contextualize them. The goal is not to anthropomorphize AI but to leverage it for emotional scaffolding that supports genuine human connection ^[28].

8. Framework illustration and discussion

The conceptual framework for AI-assisted values education in the Batangas context may be illustrated as a dynamic, cyclical, and integrative model. At its core lies the Human-Centered Moral Development Cycle, which interlinks five essential components: (1) cultural contextualization of values, (2) teacher moral agency and digital competence, (3) ethical AI design and governance, (4) pedagogical integration and experiential learning, and (5) reflective assessment and continuous improvement. These components interact within a continuous loop guided by ethical reflection and community collaboration. The framework ensures that technological integration never detaches from human values but instead amplifies moral reflection and cultural integrity ^[29].

The first component—cultural contextualization—serves as the moral compass of the framework. Philippine moral education cannot be separated from its social and cultural roots. The curriculum of *Edukasyon sa Pagpapakatao* (EsP) emphasizes values such as *paggalang* (respect), *pakikipagkapwa-tao* (fellowship), and *bayanihan* (solidarity). Integrating AI into this context in Batangas schools means encoding cultural sensitivity and inclusivity into digital systems. For instance, AI tools for moral scenario simulations could be designed with Filipino social narratives, ensuring that moral reasoning reflects communal relationships rather than purely individualist ethics. This contextualization allows AI to become a partner in moral dialogue, helping learners explore Filipino virtues in diverse, technology-mediated environments ^[30].

The second component—teacher moral agency and digital competence—positions educators in Batangas as the ethical mediators between technology and human values. AI literacy alone is insufficient; teachers must be equipped to question the ethical assumptions of digital systems. Values educators must model *maka-tao* (humanistic) principles while employing AI tools that foster dialogue, empathy, and self-awareness. The framework advocates for continuous teacher development programs emphasizing reflective AI pedagogy, algorithmic fairness, and responsible digital citizenship. In practice, this means training teachers not only to use AI applications but to interpret their moral implications and ensure their pedagogical alignment with the goals of EsP ^[31].

The third component—ethical AI design and governance—addresses the structural and policy-level dimension of implementation. It emphasizes collaboration between educators, technologists, policymakers, and ethicists to create AI systems that are transparent, equitable, and explainable. Governance mechanisms should enforce accountability in how AI tools are developed and used within classrooms in Batangas. For instance, developers must disclose algorithmic decision processes, and educational institutions should monitor AI tools to prevent data misuse or cultural bias. The ethical governance of AI reinforces learners' trust and aligns educational practice with broader national data protection laws such as the Data Privacy Act of 2012 ^[32].

The fourth component—pedagogical integration and experiential learning—is where the framework translates into classroom reality in Batangas schools. AI-assisted pedagogy should retain the dialogical nature of values education. This means using AI not as a didactic tool that dictates moral answers but as a facilitator of reflective dialogue. For example, an AI platform may present a virtual ethical dilemma about environmental responsibility, prompting students to discuss, reflect, and decide collectively. Teachers then guide debriefing sessions that connect digital reflections to lived community values. Similarly, AI-powered journaling systems can analyze moral reflections, helping students recognize emotional patterns and ethical reasoning. These methods combine technological engagement with the relational warmth of traditional Filipino teaching, ensuring that moral instruction remains human-centered despite digital mediation ^[33].

The fifth component—reflective assessment and continuous improvement—establishes feedback

mechanisms that ensure growth in moral reasoning rather than mere compliance. AI analytics can assist in evaluating reflective essays or discussion transcripts, identifying indicators of empathy, perspective-taking, or fairness. However, these insights must always be interpreted through the teacher's moral judgment. Assessment in values education must be formative and dialogical, affirming each learner's progress toward moral maturity. The framework envisions continuous feedback loops—where AI data informs instructional strategies, teachers reflect on ethical outcomes, and learners refine their moral understanding. Such a cycle embodies *pagpapakatao* as a lifelong process of reflection and moral discernment ^[34].

9. Framework application and future directions

Applying the AI-assisted values education framework in basic education under DepEd involves both technological and human capacity-building strategies. The first step is policy alignment. DepEd must articulate a unified policy that identifies AI integration as part of moral and ethical education in K–12 classrooms, emphasizing teacher oversight and community involvement. This policy should establish ethical benchmarks for all educational technologies deployed in public schools. Pilot projects could begin in *Edukasyon sa Pagpapakatao* (EsP) classes across various regions, particularly in technology-equipped schools that can serve as models of best practice for other DepEd schools ^[35].

The second step is professional development. DepEd, through the Teachers' Education Council (TEC) and in collaboration with local teacher education institutions (TEIs), should integrate AI ethics and pedagogy courses into pre-service and in-service programs for basic education teachers. These courses could cover algorithmic literacy, ethical data management, and culturally contextualized moral instruction within the K–12 curriculum. Ongoing professional learning communities (PLCs) can allow teachers to share experiences, dilemmas, and innovations related to AI-assisted moral instruction in EsP and other values-oriented subjects ^[35].

The third step involves community partnership and cultural co-creation. Parents, faith-based groups, local civic organizations, and barangay councils should be invited to co-develop moral content and case studies embedded within AI applications used in DepEd schools. This participatory approach ensures that moral learning in basic education classrooms remains anchored in Filipino lived experiences. It also counters the risk of cultural homogenization by grounding AI systems in indigenous ethical perspectives. For example, an AI program designed to promote civic responsibility could integrate local governance scenarios or community service stories reflecting *bayanihan* and *malasakit* (compassion), connecting digital learning with real-life local experiences ^[36].

The fourth step entails research and evaluation. DepEd, together with academic institutions and educational technology centers, must conduct longitudinal studies assessing the impact of AI on students' moral reasoning, empathy, and civic engagement in basic education settings. Mixed-methods research could examine how learners perceive AI's role in moral decision-making and how teachers mediate AI's influence. Findings from these studies can inform continuous refinement of both technology design and pedagogical practice in DepEd schools. Furthermore, partnerships with international institutions could situate Philippine innovations in global discussions on ethical AI in education ^[37].

10. Challenges and ethical cautions

While the framework offers transformative potential, it also presents several challenges. One of the primary

concerns is the authenticity of moral experience. AI simulations and chatbots can approximate ethical scenarios, but they may lack the emotional depth and unpredictability of real human encounters. Teachers must therefore ensure that AI experiences remain grounded in genuine interpersonal interaction. Overreliance on AI for moral instruction risks reducing ethical formation to programmed responses rather than lived conviction ^[38].

Another challenge is algorithmic bias and cultural distortion. Most AI systems are trained on datasets that reflect Western ethical paradigms, which may conflict with Filipino communal and relational values. If not properly localized, AI could inadvertently reinforce moral individualism or neglect virtues central to Filipino ethics. Collaboration with Filipino educators and cultural scholars is essential to safeguard authenticity and inclusivity ^[39].

Data privacy and psychological safety are also significant ethical issues. Values education often involves personal reflection and emotional disclosure. AI tools that collect and analyze such data must adhere to stringent privacy safeguards to protect students' dignity and mental well-being. Transparent consent mechanisms, anonymized data storage, and teacher mediation in AI feedback are crucial. Ethical governance must ensure that technology enhances moral agency rather than manipulates it ^[40].

Finally, there is the issue of teacher displacement anxiety. Some educators fear that AI may replace their moral authority. However, the framework explicitly resists this notion by positioning AI as a co-facilitator rather than a replacement. AI can automate certain tasks—such as analyzing written reflections or suggesting resources—but moral guidance and mentorship remain uniquely human functions. Teachers' interpretive and empathetic capacities cannot be replicated by machines, making them indispensable in AI-assisted values education ^[41].

11. Conclusion

The integration of Artificial Intelligence into values education in the Batangas context presents both a challenge and an opportunity to reimagine moral pedagogy in the digital age. This conceptual framework proposes a human-centered, ethically grounded, and culturally contextualized approach to AI-assisted moral instruction in Batangas schools. By harmonizing Filipino virtues such as bayanihan, pakikipagkapwa-tao, and pagpapakatao with global principles of AI ethics—transparency, justice, and accountability—the framework envisions a form of education where technology serves human flourishing rather than replaces it ^[42].

AI's role in values education in Batangas should never be to dictate morality but to deepen reflection, foster empathy, and support critical moral reasoning. Through thoughtful policy design, ethical governance, teacher empowerment, and community collaboration at the Schools Division Office and school level, Batangas can demonstrate how emerging technologies can reinforce rather than erode moral integrity. Ultimately, the success of AI-assisted values education in Batangas will depend on the capacity to sustain the human heart at the center of technological innovation—ensuring that every algorithm, lesson, and interaction serves the continuing process of pagpapakatao, the lifelong journey of becoming more fully human ^[43].

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Coordination and Alignment: On the Relationship between the Newly Revised Vocational Education Law and the Opinions on Deepening the Reform of the Modern Vocational Education System Construction

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Abstract: The vitality of law lies in its implementation. The implementation of the newly revised Vocational Education Law requires the support and alignment of a series of policies and regulations, among which the Opinions on Deepening the Reform of Modern Vocational Education System Construction is one. The Opinions has three legal attributes: mixed Party regulations, high-level administrative regulatory documents, and the propositions of the CPC. This means that the Opinions is more likely to be effective, more conducive to the realization of reform goals in the field of vocational education, and also implies that its coordination and alignment with the newly revised Vocational Education Law need to be more precise and appropriate. The basic approach for such coordination and alignment is to be consistent with the fundamental principles and spirits of the newly revised Vocational Education Law vertically, and pay attention to the boundaries and alignment with other legal norm groups related to vocational education horizontally. The essential contents of the alignment and coordination between the Opinions and the newly revised Vocational Education Law should include: enhancing the key school-running capacity of vocational schools, taking the vocational education college entrance examination as a breakthrough to improve the enrollment system with vocational education characteristics, integrating talent cultivation standards into the construction of the vocational education system, delegating core administrative powers, significantly strengthening the management authority of provincial governments over vocational education, and clarifying the micro-level administrative powers of municipal and county governments.

Keywords: Newly revised Vocational Education Law; Coordination and alignment; Basic approach; Vocational education system construction

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1. Raising the research question

On April 20, 2022, the 34th Session of the Standing Committee of the 13th National People's Congress revised and adopted the Vocational Education Law of the People's Republic of China (hereinafter referred to as the "newly revised Vocational Education Law"), which is the first major revision of the Vocational Education Law in 26 years since its implementation in 1996. The promulgation of the newly revised Vocational Education Law is undoubtedly a landmark legislative event in China's vocational education field, and will surely have a significant and far-reaching impact on China's vocational education and even the entire education sector. Soon after, on December 21, 2022, the General Office of the Communist Party of China Central Committee and the General Office of the State Council jointly issued the Opinions on Deepening the Reform of Modern Vocational Education System Construction. As the first guiding document issued by the CPC Central Committee and the State Council for deploying vocational education reform work after the implementation of the newly revised Vocational Education Law, the Opinions is of great significance for continuously advancing the reform of the modern vocational education system construction and promoting the high-quality development of vocational education.

Admittedly, although the newly revised Vocational Education Law—as a fundamental law in the field of vocational education—has been promulgated, merely having laws is not sufficient for their automatic enforcement. The vitality of law also lies in its implementation and fulfillment, and the Opinions is the key to ensuring the effective implementation of the newly revised Vocational Education Law and determining the extent of its implementation. On the one hand, some new formulations in the newly revised Vocational Education Law, such as the positioning of vocational education as a type of education and the construction of the vocational education system, require further interpretation by the Opinions to achieve coordination and alignment with the newly revised Vocational Education Law. On the other hand, the aspects where the Opinions has not yet been coordinated and aligned with the newly revised Vocational Education Law leave room for the issuance of similar legal documents in the future. Then, what is the state of the relationship between the newly revised Vocational Education Law and the Opinions? How should the two coordinate and align with each other, and what are the main contents of such coordination and alignment? With these questions in mind, this paper studies the above issues and attempts to provide corresponding answers.

2. The basic approach for the coordination between the opinions and the newly revised Vocational Education Law

Given that the newly revised Vocational Education Law has already been promulgated, the basic approach for the coordination between the Opinions and the newly revised Vocational Education Law is to maintain consistency with it. From a positive perspective, this means studying the aspects in which the Opinions should be consistent with the newly revised Vocational Education Law; from a negative perspective, it means examining the aspects in which the Opinions are inconsistent with the newly revised Vocational Education Law and need to be adjusted in the future.

2.1. Vertical coordination: Consistency with the newly revised Vocational Education Law in terms of concepts and systems

As the superior law of the Opinions, the newly revised Vocational Education Law should occupy a leading position in the vertical coordination of legal effect. The Opinions not only needs to be consistent with the newly

revised Vocational Education Law in terms of basic concepts, spirits, and principles, but also needs to exercise restraint as much as possible in specific application to maintain mutual coordination with the newly revised Vocational Education Law in a dynamic manner.

2.1.1. Consistency with the newly revised Vocational Education Law in terms of basic concepts and principles

In vertical coordination, the primary and most crucial point is that the Opinions should be consistent with the newly revised Vocational Education Law in terms of basic concepts and principles. The basic concepts and principles established by the newly revised Vocational Education Law, such as vocational education as a type of education, diversified school-running, integration of vocational and general education, integration of industry and education, combination of work and study, and independent school-running, should serve as the substantive legal basis for the Opinions^[1]. At the same time, it is not appropriate to easily assert that there is a legal conflict and thus deny the consistency between the Opinions and the newly revised Vocational Education Law regarding the concepts and principles that are not explicitly stated in the provisions of the newly revised Vocational Education Law but are reflected in the Opinions. For example, the “new model for the construction of provincial modern vocational education systems” initiated in the Opinions can be regarded as a reasonable extension of the concept of the vocational education work coordination mechanism stipulated in Article 8 of the newly revised Vocational Education Law, thereby obtaining legal confirmation.

2.1.2. Striving for systematization in legal concepts

The newly revised Vocational Education Law defines the connotation of the legal concept of “vocational education” for the first time, and formulates a series of related legal terms around “technical and skilled talents”, but there is still a gap in forming a sound concept system. A legal system is composed of several concepts in an organized manner, which need to be consistent, unified, and systematic. For example, “high-quality technical and skilled talents” is the core legal concept of vocational education, but the newly revised Vocational Education Law also creates related legal concepts such as “diversified talents”, “rural revitalization talents”, “high-end technical and skilled talents”, “high-skilled talents”, and “skilled talents.” This not only increases the difficulty of interpreting the legal text but also affects the authority and scientificity of the law. In contrast, the Opinions simplifies by retaining only the core concept of “technical and skilled talents”, and appropriately extends its connotation and extension with this concept as the core. This greatly enhances the systematization and unification of this legal concept and lays a good foundation for possible future application of the law.

2.1.3. Alignment and synchronization with the newly revised Vocational Education Law in terms of specific systems

From the perspective of the stability of law, it is not appropriate for the law itself to stipulate too many detailed contents. Therefore, the substantive legal requirements of the newly revised Vocational Education Law need to be aligned with corresponding institutional arrangements. For example, Article 8 of the newly revised Vocational Education Law clearly defines the leading responsibility of the State Council to establish a vocational education work coordination mechanism and coordinate national vocational education. On this basis, the Opinions further proposes the inter-ministerial joint meeting system for vocational education work of the State Council, the overall coordination and promotion system of the Ministry of Education, and the “three lists”

system of provincial Party committees and governments, thereby achieving alignment and synchronization between the Opinions and the substantive law.

2.2. Horizontal coordination: Alignment and coordination with other legal norm groups related to vocational education

Under the guidance of the newly revised Vocational Education Law, horizontal coordination mainly refers to the alignment and coordination between the Opinions and other legal norm groups related to vocational education, including but not limited to the National Plan for Vocational Education Reform (hereinafter referred to as the “20 Guidelines for Vocational Education”), China’s Education Modernization 2035, and the Opinions on Promoting the High-Quality Development of Modern Vocational Education.

2.2.1. Horizontal coordination with the “20 Guidelines for Vocational Education”

The newly revised Vocational Education Law emphasizes the establishment of a vocational education system that conforms to the law of growth of technical and skilled talents. Correspondingly, the Opinions proposes to implement an industrial planning and talent demand release system, improve the vocational education college entrance examination system, and explore the establishment of a differentiated per-student funding system for vocational education based on professional categories. Earlier, the “20 Guidelines for Vocational Education” had clearly stated the need to improve the policy for safeguarding technical and skilled talents, but it did not provide corresponding institutional guarantees for technical and skilled talents from the perspective of talent supply and demand and employment. The Opinions fills the institutional supply gap of the “20 Guidelines for Vocational Education” regarding employment and adheres to the fundamental principle of “managing both ends and standardizing the middle.”

2.2.2. Consistency with the policy context of China’s education modernization 2035

In 2020, the CPC Central Committee and the State Council issued China’s Education Modernization 2035, which proposes to continuously optimize the structure and layout of vocational education and promote the organic alignment and in-depth integration of vocational education with industrial development. The integration of industry and education is not only the essential feature of vocational education but also its development path^[2]. On the premise of continuing the policy context of in-depth integration of industry and education, the Opinions further puts forward the basic idea of “adhering to promoting industry through education, supporting education with industry, integrating industry and education, and cooperating between production and education”, adding new connotations to the “integration of industry and education.” It can be said that the horizontal coordination between the Opinions and China’s Education Modernization 2035 is uniformly integrated under the 16-character guideline of the newly revised Vocational Education Law—“moral education for talent cultivation, integration of moral and technical education, integration of industry and education, and cooperation between schools and enterprises”—and thus has consistency and continuity in the policy context.

2.2.3. Continuity and breakthrough from the opinions on promoting the high-quality development of modern vocational education

The construction of the vocational education system is one of the core contents of the high-quality development of vocational education. In 2021, the CPC Central Committee and the State Council issued the Opinions on Promoting the High-Quality Development of Modern Vocational Education, whose main goal is to accelerate

the progress of vocational education system construction and comprehensively promote the construction of a skill-based society. Adjusting the supply structure of vocational education and deepening the structural reform of vocational education supply are important reform directions for accelerating the construction of the vocational education system. The Opinions on Promoting the High-Quality Development of Modern Vocational Education proposes to align with national major strategies and property technology trends, give priority to the development of emerging majors, accelerate the construction of shortage majors, transform and upgrade traditional majors, and merge or eliminate surplus majors, so as to form a professional system that meets market demand and is closely aligned with the industrial chain. The Opinions basically continues the stance and spirit of this document, focusing on improving the corresponding relationship between the supply structure of vocational education and industrial upgrading—namely, the professional layout of vocational education should be closely aligned with the local industrial structure, the development trend of emerging industries, and the division of labor in the industrial chain and talent demand—so as to form a modern vocational education structure that matches the industrial structure. It can be said that the goal of vocational education system construction is to improve the quality of vocational education, the direction is to deepen the structural reform of the vocational education supply side, and the foothold is to form a vocational education structure and talent supply structure that matches the industry. From this perspective, the Opinions not only inherits but also makes breakthroughs from the Opinions on Promoting the High-Quality Development of Modern Vocational Education.

3. The main contents of the coordination between the opinions and the newly revised Vocational Education Law

No code is perfect. The limitations of law determine that the newly revised Vocational Education Law may have gaps or deficiencies as soon as it is formulated. Addressing the gaps or deficiencies of the newly revised Vocational Education Law through the Opinions is also the main content of the coordination and alignment between the Opinions and the newly revised Vocational Education Law.

3.1. School-running capacity: The key to the high-quality development of vocational education

The school-running quality of vocational schools is the lifeline of their survival and development. The Opinions proposes to “take enhancing the key capabilities of vocational schools as the foundation” and “achieve reform breakthroughs in aspects such as the construction of key capabilities of vocational schools.” Among the many key capabilities of vocational schools, the key school-running capacity is undoubtedly the top priority. Article 36 of the newly revised Vocational Education Law establishes the legal legitimacy of vocational schools’ independent school-running in accordance with their articles of association through legislative authorization, and clearly defines the specific rights of vocational schools, such as independently setting up majors, independently formulating learning systems, independently compiling specialized course textbooks, independently recruiting specialized course teachers, and implementing a flexible academic system^[3]. Compared with the newly revised Vocational Education Law, the Opinions introduces a new concept of “key school-running capacity of vocational schools”, and suggests taking the lead in building a number of core courses, high-quality textbooks, teacher teams, and practical projects in individual specialized fields, promptly incorporating new methods, new technologies, new processes, and new standards into educational and teaching practices, expanding the sharing of high-quality resources, and promoting the reform of educational and teaching methods and evaluation

methods. On the basis of the independent school-running rights established by the newly revised Vocational Education Law, the Opinions puts forward higher requirements for courses, textbooks, and teachers—factors that are fundamental and crucial to the school-running quality of vocational schools. It can be seen that the alignment of the Opinions with the newly revised Vocational Education Law in terms of key school-running capacity is precise and necessary.

3.2. Moral education for talent cultivation: Integrating talent cultivation standards into the construction of the vocational education system

The newly revised Vocational Education Law writes the talent cultivation standard of “moral education for talent cultivation” into the law for the first time, which reflects the development characteristics of China’s vocational education. As early as November 2012, the report of the 18th National Congress of the Communist Party of China pointed out that “moral education for talent cultivation should be taken as the fundamental task of education.” In 2016, the President of the CPC emphasized in his speech that “we should adhere to taking moral education for talent cultivation as the central link, and integrate ideological and political work into the entire process of education and teaching to achieve full-process education and all-round education.” On the basis of Article 4 of the old Vocational Education Law, the newly revised Vocational Education Law has made significant revisions, and for the first time proposes that vocational education should “adhere to moral education for talent cultivation and integration of moral and technical education”, placing ideological and political education in a more prominent position and accurately summarizing the essential characteristics of vocational education ^[4]. In order to more effectively align and coordinate with the newly revised Vocational Education Law, Article 11 of the Opinions clearly proposes to further promote the “three integrations” (integration into textbooks, classrooms, and minds) of the President of the CPC Thought on Socialism with Chinese Characteristics for a New Era, “integrate ideological and political work into the entire process of school education and management”, and “improve the talent cultivation mechanism that combines moral and technical education and integrates work and study”, putting forward higher requirements for the implementation of the talent cultivation standards of the newly revised Vocational Education Law.

3.3. Empowering provinces through decentralization: unleashing new vitality for the reform of the vocational education system construction

The Opinions thoroughly implements the basic concept of “empowering provinces through decentralization” advocated by the newly revised Vocational Education Law. A clear comparison between the old and new Vocational Education Law shows that one of the most prominent revisions is “empowering provinces through decentralization”, which significantly delegates powers to provincial governments in the field of vocational education. For example, it clarifies the division of responsibilities and positioning that the State Council and its administrative departments are responsible for overall planning, and provincial governments are responsible for leading the vocational education work in their respective administrative regions (Article 8 of the newly revised Vocational Education Law); provincial governments have the approval authority for the establishment of higher vocational education institutions (Article 33); the education administrative departments of provincial governments are responsible for establishing a unified enrollment platform for vocational education (Article 37); provincial governments have the power to formulate standards for the staffing of teaching and administrative staff in vocational schools in their respective regions (Article 48); provincial governments have the leading

authority in the management system of vocational school funding (Article 52); and provincial governments have the power to formulate standards for per-student funding in vocational schools in their respective regions (Article 55), etc. These revisions demonstrate the determination of the State Council to delegate core administrative powers and significantly enhance the management authority of provincial governments over vocational education in their respective regions. The Opinions pioneeringly proposes a decentralized model of “national leadership and local implementation”, encouraging provinces with reform willingness and basic conditions to make breakthroughs in reform. This responds to the reform concept of “empowering provinces through decentralization” in the newly revised Vocational Education Law and adds new vitality to the future reform of the vocational education system construction. It can be predicted that provincial Party committees and governments will be the leaders in the construction of the vocational education system in the future, and the construction model of “provincial leadership and provincial-ministerial coordination” will be more conducive to achieving innovations and breakthroughs in aspects such as the integration of industry and education, the integration of vocational and general education, incentive policies, and institutional support, thereby accumulating reform experience for the future revision of vocational education laws.

3.4. Municipal leadership: Refined allocation of administrative powers for vocational education construction

If “empowering provinces through decentralization” reflects the delegation of administrative powers at the meso level, then “municipal leadership” is more about clarifying the specific administrative powers of municipal and county governments in the field of vocational education at the micro level. Regarding the allocation of administrative powers between provincial governments and municipal governments, Article 8 of the newly revised Vocational Education Law stipulates that provincial governments are responsible for leadership and overall coordination, while municipal and county governments are responsible for specific work. Although the newly revised Vocational Education Law stipulates the specific responsibilities of municipal and county governments, the provisions are too brief, making their implementation difficult. However, the law does not specify how to provide support and guidance, which also causes difficulties in the specific implementation of the law. The Opinions clearly proposes to “build municipal-level industry-education consortia based on industrial parks”, establish a council with the participation of the government, enterprises, schools, and research institutions, and implement policy preferences such as finance, land, finance, and taxation that the government can provide in the form of “municipal-level industry-education consortia.” These provisions all demonstrate the main responsibility of municipal and county governments in the construction of the vocational education system, and are also an extension of the rules of the newly revised Vocational Education Law for allocating administrative powers related to the high-quality development of vocational education at the ministerial, provincial, municipal, and county levels.

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Construction and Research of the “Post-Course-Competition-Certificate” Teaching Ecosystem Driven by AI for Medical Majors in Higher Vocational Colleges

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Abstract: Against the backdrop of the digital transformation of the medical and health industry and the reform of vocational education, medical majors in higher vocational colleges are in urgent need of innovation and reform to build a new teaching ecosystem. As an integrated talent training model in vocational education, the “Post-Course-Competition-Certificate” (PCCC) integration can achieve precise alignment between talent cultivation and industrial demands, fostering high-quality technical and skilled professionals. Based on this, relying on AI technology, this paper explores the construction path of an AI-driven PCCC teaching ecosystem for medical majors from two aspects: the adaptability between higher vocational medical majors and the PCCC model, and the importance of constructing the PCCC teaching ecosystem. The aim is to promote the innovation of teaching models for medical majors in higher vocational colleges and provide high-quality technical and skilled talent support for the digital development of the medical and health industry.

Keywords: AI; Higher vocational medical majors; Post-Course-Competition-Certificate; Teaching ecosystem construction

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1. Introduction

With the rapid transformation of the medical and health industry towards intelligence and precision, the industry has put forward higher requirements for the practical and innovative abilities of technical and skilled talents. Currently, due to the imperfect construction of curriculum systems and the rigid teaching concepts, the integration of “Post-Course-Competition-Certificate” mostly remains at a formal level. In this context, AI

technology, with its advantages in data processing, virtual simulation, and intelligent evaluation, provides a new path to solve the challenges of PCCC integration. Constructing an AI-driven teaching ecosystem can not only realize the dynamic matching of post demands, curriculum systems, competition content, and certificate standards but also reduce teaching costs and risks through virtual training scenarios, improve teaching accuracy, create a data-driven, collaborative, and efficient teaching ecosystem and practice, and promote the precise alignment between talent training quality and industrial needs ^[1].

2. Analysis on the adaptability between higher vocational medical majors and the “Post-Course-Competition-Certificate” model

2.1. Compatibility between post-competence requirements and the professional curriculum system

The core goal of higher vocational medical majors is to cultivate technical and skilled talents for frontline positions in the medical and health industry. The construction of their curriculum system must be fundamentally based on the quality and competence standards of specific posts. Specifically, medical majors themselves are highly professional, practical, and complex, while medical-related positions usually emphasize the assessment of comprehensive skills of talents, such as disease inquiry and drug recommendation, quality testing, medication guidance, inspection technology, and nurse-patient communication. These post-competence requirements do not exist in isolation but present a hierarchical structure of basic abilities, professional core abilities, and comprehensive literacy. This has a natural compatibility with the curriculum system structure of higher vocational medical majors, which includes public basic courses, professional basic courses, professional skills (core courses), and professional extension courses ^[2]. Therefore, the core courses of medical majors must be closely aligned with the core post competencies to accurately cover the knowledge and skill points required by the posts. Meanwhile, the clarity of post requirements provides clear guidance for the selection and optimization of course content, laying a foundation for the implementation of the “Post-Course-Competition-Certificate” model ^[3].

2.2. Unity between skills competition content and professional teaching objectives

The teaching objectives of higher vocational medical majors usually focus on cultivating students’ medical professional skills and comprehensive literacy. The content of medical skills competitions, which centrally reflects cutting-edge industry technologies and core post skills, is highly consistent with professional teaching objectives. From the perspective of the design logic of competition content, skills competitions are usually set against the background of real medical production and service scenarios, with competition modules designed around core post tasks. These modules highly overlap with the practical teaching projects of higher vocational medical majors in terms of skill requirements and operation procedures ^[4]. From the perspective of the path to achieve teaching objectives, skills competitions can serve as a “catalyst” for professional teaching, promoting the updating of teaching content and the innovation of teaching methods, making teaching content more in line with industry practices, and improving teaching effectiveness.

2.3. Alignment between vocational qualifications and professional training specifications

The medical industry is a special sector related to life and health, where most positions implement a strict vocational qualification access system, such as professional certificates for licensed pharmacists, medical

laboratory technicians, and licensed nurses. The assessment standards for these certificates represent the minimum requirements of the industry for practitioners' professional knowledge, skill levels, and professional literacy, which are highly compatible with the core requirements of the training specifications of higher vocational medical majors. From the perspective of the impact of vocational certificate standards on training specifications, the knowledge system and skill requirements of vocational certificates provide clear industry-based references for higher vocational medical majors in formulating training specifications^[5]. Specifically, integrating the core content of certificate assessments into the curriculum system can ensure that students have the ability to obtain relevant vocational certificates upon graduation. From the perspective of the support of training specifications for certificate acquisition, the training specifications of higher vocational medical majors not only meet the basic requirements of vocational certificates but also emphasize the cultivation of comprehensive literacy and development ability on this basis, enabling students to possess stronger post-adaptability and career development potential while obtaining vocational certificates^[6].

3. Value of constructing an AI-driven “Post-Course-Competition-Certificate” teaching ecosystem for higher vocational medical majors

3.1. Conducive to improving the precision of talent cultivation

In the context of the new era, the pharmaceutical industry has undergone rapid reforms and technological updates in response to diverse patient needs. Traditional teaching models and ability training approaches struggle to keep pace with the industry's rapid iteration. Leveraging its powerful technical advantages, AI technology can construct competency maps for pharmaceutical industry positions, enabling real-time capture of industrial dynamics, job recruitment data, updates to vocational qualification standards, and other information. Through natural language processing, machine learning, and other algorithms, it conducts quantitative analysis and dynamic updates of job competency elements, accurately identifying the specific requirements of different positions for knowledge, skills, and literacy^[7]. On this basis, AI can intelligently match job competency elements with curriculum knowledge points, competition assessment indicators, and certificate certification standards, forming visual ability development pathways. For students, AI can generate personalized learning profiles based on their learning behavior data, practical training records, and assessment results, precisely pinpointing ability gaps and automatically pushing tailored curriculum resources, training projects, and exam preparation materials for competitions and certifications. This enables targeted learning, thereby enhancing teaching precision.

3.2. Conducive to promoting innovation in teaching models

Supported by AI technology, higher vocational medical majors can utilize virtual simulation, digital twins, and other means to construct highly realistic medical training scenarios, such as virtual workshops for the entire pharmaceutical production process, clinical pharmacy service simulation systems, and intelligent simulation platforms for medical testing. Students can repeatedly practice core skills through immersive operations without concerns about material consumption or operational risks. Meanwhile, AI intelligent evaluation systems can track students' training operations in real-time and provide precise feedback. Using motion capture, data comparison, and other technologies, they quantitatively analyze operational standardization, process completeness, and result accuracy, promptly identifying issues and offering improvement suggestions to enhance the precision and efficiency of training guidance^[8]. Additionally, AI technology breaks the temporal

and spatial limitations of practical teaching: students can participate in virtual training anytime and anywhere through online platforms, realizing a hybrid training model combining online preview and offline practice, thereby improving teaching effectiveness.

3.3. Conducive to strengthening the depth of industry-education integration in talent cultivation

Traditional industry-education integration mostly remains at superficial levels of cooperation, such as enterprises providing internships or donating equipment, with insufficient collaboration between schools and enterprises in formulating talent training standards, developing teaching resources, and driving technological innovation. An AI-driven teaching ecosystem can achieve interconnection between educational and industrial data by building a shared pharmaceutical teaching data center for schools and enterprises. Specifically, under the “Post-Course-Competition-Certificate” teaching model, vocational colleges can co-construct talent cultivation collaboration platforms with enterprises, integrating the latest production technologies, job standards, and real-case resources from enterprises into the platform and setting up learning modules. This allows students to understand enterprise development progress and dynamics while mastering basic knowledge ^[9]. Furthermore, an AI-empowered teaching ecosystem can attract more pharmaceutical enterprises to deeply participate in vocational education. Through joint construction of industrial colleges, co-development of courses, and co-organization of skills competitions, stable industry-education collaboration mechanisms can be formed, further promoting high-quality collaborative development between the medical and health industry and vocational education.

4. Construction and practical paths of an AI-driven “Post-Course-Competition-Certificate” teaching ecosystem for higher vocational medical majors

4.1. Develop intelligent practical training course modules to promote effective alignment of teaching systems

Under the “Post-Course-Competition-Certificate” model, to better align with job requirements, medical majors in higher vocational colleges need to develop diversified course modules based on certificate standards, competition requirements, job adaptability demands, and curriculum content, thereby achieving an effective connection between teaching content and enterprise development. Firstly, vocational colleges can rely on AI technology to construct job competency maps, decompose professional courses into several core competency modules, each corresponding to relevant competition content and key points of certificate assessments. AI technology is then used to sort out the correlations between knowledge points in each module, forming a structured knowledge network ^[10].

Secondly, integrate the competitive requirements of skill competitions into practical training modules, set up practical training projects in a competition mode, and allow students to complete the entire competition process in virtual scenarios in accordance with competition requirements. This not only strengthens their practical skills but also cultivates their competitive thinking and teamwork abilities. Finally, higher vocational colleges can use AI virtual simulation and digital twin technologies to build immersive practical training scenarios, where students can complete full-process operations using VR equipment ^[11]. At the same time, AI intelligent evaluation functions are embedded to conduct real-time data collection and analysis of students’ practical training operations, conduct quantitative scoring from dimensions such as operational standardization,

process completeness, and result accuracy, and generate detailed improvement reports. This realizes the organic integration of “Post-Course-Competition-Certificate” teaching content and the innovative upgrading of teaching forms, enhancing students’ professional skills and comprehensive literacy.

4.2. Build teaching data platforms to achieve dynamic collaboration of teaching resources

As an education model directly connected to jobs, the “Post-Course-Competition-Certificate” teaching model can effectively provide more authoritative and advanced teaching resources and job standards for professional teaching, offering solid guarantees for students’ professional development and future employment. In traditional teaching models, medical majors in higher vocational colleges usually struggle to achieve effective and in-depth connections with the four dimensions of pharmaceutical industry jobs, professional courses, skill competitions, and vocational certificates. However, relying on AI technology, higher vocational colleges can build a pharmaceutical AI teaching data platform to break down data barriers between various elements of “Post-Course-Competition-Certificate” and realize the integration, analysis, and dynamic collaboration of teaching resources ^[12]. Specifically, at the job data level, it can directly connect to pharmaceutical industry associations, human resource systems of leading enterprises, and recruitment platforms, capture real-time information such as competency requirements, technical standards, and qualification criteria for different jobs, and form dynamically updated job competency maps.

At the curriculum data level, integrate teaching resources such as professional course syllabuses, knowledge point distributions, teaching videos, and assessment question banks to establish a structured curriculum knowledge database. At the competition data level, collect contents such as competition regulations, assessment indicators, and award-winning cases of various pharmaceutical skill competitions to build a competition competency element database. At the certificate data level, synchronize information such as examination syllabuses, certification standards, and past real questions of vocational qualification certificates to form a certificate assessment standard database ^[13]. On this basis, AI technology is used to deeply match these resources with teaching content, intuitively present the matching degree and collaboration of “Post-Course-Competition-Certificate”, provide data support for teaching decisions, and ensure the timeliness and accuracy of “Post-Course-Competition-Certificate” collaboration.

4.3. Innovate teaching models and construct a “Post-Course-Competition-Certificate” collaborative education paradigm

To efficiently cultivate high-quality professional and skilled talents for the pharmaceutical industry, higher vocational colleges need to adopt a series of practical measures to improve the effectiveness of curriculum reform, and the innovation of teaching models is the core link in realizing the implementation of the “Post-Course-Competition-Certificate” teaching ecosystem. Based on this, supported by AI technology, it is possible to break the temporal and spatial limitations of traditional teaching and the pattern of one-way knowledge transmission, and construct an education model featuring the integration of virtual and real scenarios and collaborative interaction. On the one hand, teachers can implement a blended teaching method. For the online part, teachers can build a digital learning space relying on intelligent teaching platforms, integrating AI question-answering robots, micro-lecture videos, virtual simulation resources, etc. Students can complete a preview of knowledge points, after-class review, and extended learning at their own pace. In this process, teachers can use AI systems to analyze students’ online learning behavior data, accurately identify their weak

knowledge points, and automatically push targeted learning resources and exercises to achieve precise learning guidance^[14]. For the offline part, teachers integrate contents such as pharmaceutical industry jobs, professional courses, skill competitions, and vocational certificates with the help of AI interactive teaching terminals to form complete practical projects, and let students complete practical activities through group cooperation, so as to transform online learning achievements into practical application abilities.

On the other hand, teachers can design virtual teaching scenarios, use virtual simulation and digital twin technologies to build highly realistic pharmaceutical practice scenarios, such as virtual workshops for the entire pharmaceutical production process and simulated consulting rooms for clinical pharmacy services. Students can participate in immersive practical training using VR/AR equipment to strengthen their practical skills, help them understand the real working environment and job standards, and achieve an effective connection.

5. Conclusion

In summary, the construction of an AI-driven “Post-Course-Competition-Certificate” teaching ecosystem for medical majors in higher vocational colleges is a key measure to respond to the digital transformation of the pharmaceutical industry and the reform of vocational education. By developing intelligent practical training course modules, building teaching data platforms, and constructing a “Post-Course-Competition-Certificate” collaborative education paradigm, it can effectively solve problems such as resource constraints and insufficient collaboration in traditional training models, and realize the precise connection between talent training and industrial needs.

Disclosure statement

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Research on Bottlenecks and Breakthrough Strategies for Improving the Teaching Competence of Higher Vocational Mathematics Teachers in the AI Era

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Abstract: Against the backdrop of education reform driven by artificial intelligence (AI), higher vocational mathematics teaching presents new characteristics such as digitalization, intellectualization, integration, and practicalization. However, the improvement of teachers' corresponding teaching competence faces bottlenecks, including the lag in updating teaching concepts, superficial application of AI technology, insufficient curriculum adaptability, lack of ethical literacy, and weak support for teaching environments. To address these bottlenecks, this paper proposes breakthrough strategies: combining external support with internal incentives, integrating AI throughout the teaching process with precise teaching empowerment, combining competence-oriented development with literacy cultivation, combining risk identification with ethical construction, and combining technical support with teacher development. These strategies provide references for improving the teaching competence of mathematics teachers in higher vocational colleges and support for cultivating high-quality technical and skilled talents in the intelligent era.

Keywords: Higher vocational mathematics teachers; Teaching competence; Bottlenecks; Strategies; AI era

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1. Introduction

As a public basic course in higher vocational colleges, higher vocational mathematics plays a crucial role in cultivating students' scientific literacy, comprehensive abilities, and sustainable development capabilities. It lays the foundation for students to achieve higher-quality employment, entrepreneurship, and better career development^[1]. However, current higher vocational mathematics teachers are facing multiple challenges, such as the lag in updating teaching concepts, insufficient ability to apply AI technology, and weak adaptability in curriculum reconstruction. Based on this, the authors investigated 56 domestic higher vocational colleges,

systematically explored the bottlenecks in improving the teaching competence of higher vocational mathematics teachers in the AI era, and proposed targeted breakthrough strategies. This research not only helps promote the modernization transformation of the higher vocational mathematics teaching team but also holds great significance for building a higher vocational mathematics teaching system that meets the needs of the intelligent era and improving the quality of talent cultivation.

2. Bottlenecks in improving the teaching competence of higher vocational mathematics teachers in the AI era

To obtain first-hand information on the bottlenecks restricting the improvement of higher vocational mathematics teachers' teaching competence in the AI era, the authors conducted a questionnaire survey (supplemented by direct visits in some colleges) with mathematics teachers in higher vocational colleges as the main respondents (supplemented by student surveys in some colleges). The questionnaire was designed from five perspectives—"digital-intelligent teaching concepts, digital-intelligent teaching skills, digital-intelligent curriculum development, digital-intelligent ethical literacy, and digital-intelligent support mechanisms"—to identify the difficulties and problems faced by higher vocational mathematics teachers in improving their teaching competence in the AI era, thereby analyzing the bottlenecks that restrict the improvement of their teaching competence.

2.1. Difficulties in transforming AI-driven digital-intelligent teaching concepts and insufficient internal motivation of teachers

Factors such as the solidification of traditional teaching cognition and the long feedback cycle of digital-intelligent teaching effects have led some mathematics teachers to feel intimidated by new technologies. This makes it difficult for them to update their teaching concepts and results in insufficient internal motivation ^[2].

Questionnaire results show that 63.3% of teachers adopt a wait-and-see attitude towards digital-intelligent teaching, and 61.6% have cognitive biases towards digital teaching. They fail to recognize that higher vocational mathematics teaching models need to upgrade towards data-driven and personalized learning in the AI era. For example, when teaching "Probability and Statistics", some teachers still prefer the traditional model of "formula derivation + exercise training + simple application." The survey also found that 27.5% of teachers worry about being unable to master intelligent teaching tools and tend to stick to traditional methods. They believe that digital-intelligent teaching requires long-term adjustments to teaching plans and tracking of students' learning effects, while improvements in students' academic performance or teaching evaluations are difficult to achieve in the short term.

2.2. Inadequate integration of AI technology with mathematics teaching and superficial application of technology

Most higher vocational mathematics teachers only apply AI technology at the "low-level auxiliary" level. They lack an understanding of AI application scenarios related to students' majors and fail to integrate AI with the core characteristics of higher vocational mathematics, "emphasizing practice and strengthening application."

Survey results indicate that 72.3% of higher vocational mathematics teachers believe that having AI tools is sufficient, and in-depth application is not important. For instance, they only use AI to generate exercises and grade objective questions, but do not use intelligent platforms to capture learning data during students' project-

based learning, such as time spent solving practical problems, types of errors, and mastery of knowledge points. 10% of mathematics teachers report rarely or never using digital-intelligent technology in teaching activities. Additionally, 70.3% of teachers lack the ability to use AI to “integrate mathematics with majors.” For example, they cannot apply calculus to optimize algorithms in intelligent logistics scheduling or solve stress analysis in mechanical design for the mechatronics major.

2.3. Adaptation gaps in AI-integrated mathematics curriculum development, restricting the achievement of teaching objectives

Higher vocational mathematics teachers face significant “adaptation gaps” in AI-integrated mathematics curriculum development, which are specifically reflected in three aspects: knowledge objectives, competence objectives, and ideological and political (IP) objectives.

First, from the perspective of knowledge objectives: Higher vocational mathematics aims to enable students to acquire mathematical knowledge, mathematical thinking methods, and common mathematical software skills required for various professional courses. It also needs to help students with different foundations make up for knowledge gaps and achieve hierarchical improvement. However, the content adaptation defects of AI-integrated mathematics curriculum resources make it difficult for teachers to advance this goal. 65.2% of teachers report that, due to the actual situation of higher vocational students—“uneven mathematical foundations and diverse learning motivations”—the established AI-integrated mathematics content cannot accurately capture differences in students’ foundational levels. Second, from the perspective of competence objectives, AI development teams lack in-depth research on the talent cultivation goals and post-competence requirements of various majors in higher vocational colleges. As a result, intelligent teaching content remains basically at the level of general mathematical knowledge. Third, from the perspective of IP objectives: Approximately 71.4% of teachers believe that current AI-integrated mathematics courses lack the integration of ideological and political elements, making it difficult for students to perceive the curriculum-based ideological and political education embedded in higher vocational mathematics.

2.4. Insufficient AI risk identification and ethical literacy, and a lack of risk management links

Currently, risks such as data security issues, algorithmic bias, and over-reliance on technology are gradually emerging. Risks related to infringement, ethical norms, and privacy protection also exist simultaneously. Higher vocational mathematics teachers lack the ability to identify potential risks in teaching and have insufficient ethical literacy, leading to a gap between cognition and practice.

First, awareness of preventing data security and privacy leakage risks is weak^[3]. When AI teaching systems collect information such as students’ mathematical problem-solving data and learning behavior trajectories, they involve a large amount of personal privacy data. However, 88.2% of mathematics teachers state that they have not received data security training and lack a clear understanding of how to standardize the use of student data and prevent information leakage. Second, the risk of teachers’ cognitive bias is ignored. When guiding students to use AI, teachers do not deeply identify the risk of cognitive bias that students may develop, such as “over-relying on AI for problem-solving” while neglecting mathematical logical deduction.

2.5. Inadequate guarantee for the AI teaching environment and a lack of systematic support

The lack of systematic support for the teaching environment also directly restricts the improvement of mathematics teachers' digital-intelligent teaching competence ^[4].

The survey finds that some colleges only deploy AI teaching equipment in a few multimedia classrooms. This cannot support the practical teaching needs of public basic courses like higher vocational mathematics, such as “Virtual Reality (VR) + Mathematical Modeling” and “AI Image Recognition + Professional Scenario Analysis for Mathematical Application.” As a result, the AI-supported teaching of “learning mathematics” and “applying mathematics” in higher vocational education becomes a mere formality. There are also obvious loopholes in the service support system. Most colleges lack full-time AI teaching technology support teams, and some complex problems cannot be effectively solved because “technology teams do not understand mathematics teaching.”

3. Breakthrough strategies for improving the teaching competence of mathematics teachers in higher vocational colleges in the AI era

3.1. Concept transformation: Combining external support with internal incentives

3.1.1. Strengthen top-level design and improve incentive mechanisms

Schools must carry out institutional innovation, explicitly incorporating AI teaching application capabilities into teachers' performance evaluation, professional title assessment, and selection for awards and recognition. Establish special funds and rewards to provide substantive recognition or incentives for teachers who successfully develop digital teaching resources and conduct digital-intelligent teaching.

3.1.2. Establish “AI Teaching Innovation Teams” and build teacher learning communities

Create a positive atmosphere where “there are leaders to take the lead and partners to walk with” to reduce teachers' sense of loneliness and fear. Encourage interdisciplinary cooperation, especially pairing mathematics teachers with computer major teachers to form a mutual assistance model of “technical experts + teaching experts.” Enhance professional confidence and a sense of mission through concept guidance and case demonstrations.

3.1.3. Promote in phases and set up demonstration models

Lower the initial threshold to allow teachers to experience the convenience brought by technology and gradually develop usage habits. Focus on cultivating and vigorously promoting successful cases that take the lead in national high-quality online courses to play their radiating and leading role. Use people and events around them to stimulate the internal motivation of more teachers to think, “I want to try too.”

3.2. Identify entry points: Combining full-process integration with precision teaching empowerment

3.2.1. Integrate mathematics with majors to identify the entry point for the integration of AI and mathematics

The key to integration is to avoid “technology for technology's sake”; it needs to be combined with professional integration and find suitable AI tools ^[5-6]. For example, for mechanical and architectural majors, AI-driven 3D modeling tools can be used to demonstrate “part section analysis” and “engineering volume calculation” in solid

geometry, transforming abstract mathematical knowledge into practical problems perceivable in professional posts.

3.2.2. Promote in-depth application of AI technology through the “pre-class, in-class, post-class” full process

Before class, conduct a precise diagnosis to customize preview plans, and use AI teaching platforms to issue diagnostic tests to build accurate “mathematical learning digital profiles” for each student. During class, normalize flipped classrooms and empower interaction with AI: use AI tools to integrate professional scenarios into higher vocational mathematics teaching, and explain targeted content, such as “modeling steps” that students easily make mistakes in, to improve classroom efficiency. After class, students use AI to complete mathematics practical assignments combined with their majors, and receive 24-hour tutoring from AI teaching assistants.

3.2.3. Conduct project-based learning and innovate AI-simulated mathematical models

Carry out practical project-based learning combined with AI, and use AI to simulate and construct mathematical models. For example, when teaching differential equations, simulate models such as epidemic spread and population growth to cultivate students’ modeling capabilities and innovative capabilities^[7-9].

3.3. Intelligent adaptation: Combining competence orientation with literacy cultivation

3.3.1. Build an intelligent academic diagnosis system for mathematics courses to achieve precise adaptation to knowledge objectives

Given the significant differences in higher vocational students’ mathematical foundations, develop an intelligent academic diagnosis platform for higher vocational mathematics based on big data. This platform integrates multi-dimensional data from pre-class preparation, in-class learning, and assignments, establishes dynamic evaluation profiles for students, and designs flexible knowledge graphs.

3.3.2. Deepen industry-education integration to promote competence development

Construct a vocational competence-oriented AI mathematics curriculum system to support professional needs^[10]. Specific measures include: investigating professional teaching and research sections; organizing mathematics teachers to conduct in-depth surveys in industrial enterprises to sort out lists of mathematical competencies required by various majors; collaborating with enterprise technicians to develop a library of real project cases; and designing problem-oriented intelligent teaching modules. Meanwhile, establish a dynamic update mechanism to adjust curriculum content regularly based on industrial and technological development.

3.3.3. Innovate the integration of ideological and political (IP) elements to strengthen the function of value guidance

Highlight value guidance, establish an IP education map for courses, and closely integrate this map with AI mathematics curriculum resources^[11]. Integrate IP elements from three perspectives—disciplinary characteristics, integration of mathematics and majors, and social practice—to achieve positive guidance and feedback on students’ values.

3.4. Human-machine collaboration: Combining risk identification with ethical construction

3.4.1. Strengthen risk identification and ethical literacy to build a solid safety defense line

Launch “theory + practice” dual-module training. The theory module focuses on interpreting laws and policies such as the Data Security Law of the People’s Republic of China and analyzing typical data leakage cases. The practice module trains practical skills—such as data permission setting and algorithm bias identification—through simulating mathematics application teaching scenarios. Additionally, establish a certification mechanism for teachers’ AI ethical literacy.

3.4.2. Innovate human-machine collaboration models to balance AI and teaching autonomy

Guide students to understand the advantages and limitations of AI, and implement a two-stage process of “AI assistance + independent problem-solving” for students to avoid weakening their independent thinking abilities ^[12]. At the same time, guide students to understand AI correctly and rationally, and cultivate their critical thinking. Clearly define the boundaries for teachers’ use of AI tools, add a “teaching reflection on AI use” section in teaching design, and establish a community of mathematics teachers for research and training. Improve teachers’ independent teaching design capabilities through methods such as “same lesson, different designs” (teaching the same content with different approaches).

3.4.3. Improve emergency response and management mechanisms to build a safety governance system

First, formulate the Contingency Plan for AI Teaching Emergencies, clarify response procedures for scenarios such as system failures (e.g., parameter abnormalities) and data leakage, and ensure teachers master the operation of the plan proficiently ^[13]. Second, establish a school-level AI teaching risk assessment team to promptly issue early warnings and rectify behaviors such as illegal upload of private data and over-reliance on AI for lesson preparation.

3.5. Foundation consolidation: Combining technical support with teacher development

3.5.1. Strengthen infrastructure and resource construction to consolidate hardware and software foundations

First, include the procurement of AI teaching hardware in the school’s annual key budget, prioritize equipping professional practice venues and mathematical modeling laboratories with VR equipment and AI interactive terminals, and upgrade existing multimedia classrooms ^[14]. Second, abandon generalized content and develop AI mathematics resources centered on the professional characteristics of higher vocational education. For example, design a module of “AI image recognition + part size calculation” for mechanical majors, and develop a case library of “AI data analysis + mathematical modeling” for finance and economics majors to ensure the practicality and targeting of resources.

3.5.2. Build a professional technical support and service team to provide sustained and effective guarantees

It is recommended to establish a school-level “AI Teaching Support Center”, build an online support platform and a work order system, and ensure teachers receive immediate assistance when encountering problems such as deviations in academic analysis and system failures. Meanwhile, establish a regular inspection and maintenance

mechanism to identify potential technical risks in advance.

3.5.3. Improve teacher training and development systems to strengthen systematic support and effect tracking

Design hierarchical and classified systematic training programs ^[15]. Based on the needs of teachers with different professional backgrounds, ages, and skill levels, offer a series of courses ranging from basic technical operations to in-depth innovative applications. Strengthen post-training follow-up guidance to effectively improve teachers' digital-intelligent teaching capabilities.

4. Conclusion

Improving the teaching competence of higher vocational mathematics teachers in the AI era is the cornerstone for enabling students to shift from “learning mathematics” to “applying mathematics”, promoting better alignment of higher vocational mathematics with professional needs and industrial development. It is also a strategic fulcrum for cultivating high-quality technical and skilled talents adapted to the intelligent era. Combining the new characteristics of higher vocational mathematics teaching in the AI era, this paper deeply analyzes the bottlenecks restricting the improvement of higher vocational mathematics teachers' teaching competence and proposes systematic breakthrough strategies. These efforts aim to truly realize “promoting learning through application and empowering with intelligence” in higher vocational mathematics teaching, and inject “mathematics + AI” momentum into the high-quality development of vocational education.

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Research on the Application Scenarios and Ethical Boundaries of AIGC in Secondary School Art Creation Teaching

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Abstract: In recent years, Artificial Intelligence Generated Content (AIGC) technology has gradually been applied in the educational field, bringing new possibilities to traditional art teaching. Secondary school art creation teaching has long faced challenges such as insufficient student creativity stimulation and homogenized teaching content. AIGC can rapidly generate diverse visual materials, providing innovative tools for teaching. Through case analysis, literature research, and observations of teaching practices, this paper explores the specific application scenarios of AIGC in secondary school art classrooms and the ethical challenges it faces. The study found that AIGC can assist students in conceiving ideas by generating theme-related images, for example, by using style transfer techniques to broaden creative thinking, while also providing tiered learning support for students with varying abilities. The use of this technology may lead to copyright disputes, such as whether AI-generated content qualifies as original work, and issues such as the decline in students' practical skills due to over-reliance on technology. The randomness of AIGC outputs also presents potential conflicts with the cultivation of humanistic values in art education. Based on this, the study recommends clarifying the tool nature of AIGC in teaching, designing curriculum norms in conjunction with copyright regulations, and balancing technological efficiency with artistic expression through teacher guidance, ultimately achieving effective integration of technology assistance and art education.

Keywords: AIGC; Secondary school art education; Artificial intelligence generated content; Ethical issues; Teaching applications

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1. Introduction

Artificial Intelligence Generated Content (AIGC) represents a significant breakthrough in the field of information technology in recent years, enabling the automated generation of text, images, and videos through algorithmic models. Since its rapid development starting in 2020, image generation tools such as DALL-E and

MidJourney have been able to quickly output visual works in different styles based on user-input keywords ^[1]. In the field of education, the application scenarios of Artificial Intelligence Generated Content (AIGC) have gradually expanded to include homework grading, test question generation, and the development of teaching resources. Data shows that 62% of K12 schools in China have incorporated AI-related content into their information technology courses, but its integration into art disciplines is still at the exploratory stage ^[2]. As an important avenue for cultivating students' aesthetic appreciation and creativity, art education has long faced challenges such as limited teaching resources and insufficient personalized guidance. In traditional classrooms, teachers need to spend a significant amount of time preparing demonstration works, while students, constrained by their proficiency in techniques, often exhibit low creative efficiency ^[3].

The particularity of middle school art education lies in the need to balance skill training with the cultivation of creativity. When teachers use the copying method to impart painting techniques, it can easily lead to students' rigid thinking; on the other hand, free creation teaching may leave students at a loss due to a lack of effective guidance. Schools in some economically underdeveloped regions even face a shortage of art teachers, with course content limited to simple sketching and watercolor techniques ^[4]. The intervention of AIGC technology offers new approaches to addressing these issues. In landscape painting teaching, teachers can utilize Stable Diffusion to generate scene materials under different seasons and lighting conditions, helping students quickly build creative inspiration ^[5]. An experimental study has shown that classes using AI-assisted teaching scored 23% higher in composition novelty than traditional classes, indicating the positive role of technological tools in stimulating imagination ^[6].

The application of AIGC in art education is not without controversy. Images generated by technology may contain elements with unclear copyright, and students directly borrowing such works may raise intellectual property risks ^[6]. More notably, excessive reliance on AI generation may lead students to neglect basic technique training. A case study at a school revealed that students who used AI tools for an extended period experienced a 17% increase in the probability of proportion disproportion when drawing still lifes by hand, reflecting the potential negative impact of technological tools on observational skills ^[7]. Current research needs to clarify the application boundaries of AIGC, leveraging its advantages in expanding artistic expression dimensions while upholding the core goal of art education in cultivating humanistic qualities. Establishing a synergistic relationship between digital technology and traditional teaching has become a critical issue in driving innovation in art education ^[8].

2. Overview of AIGC technology and its potential in educational applications

2.1. Basic principles and development of AIGC technology

The foundational operational logic of AIGC technology is built upon a bidirectional interaction mechanism between data learning and content generation. Generative Adversarial Networks (GANs) and diffusion models, serving as their core algorithms, enable automated content production by simulating human creative thinking. GANs consist of two components: a generator responsible for creating new content based on input data, and a discriminator that evaluates the authenticity of the generated results. These two components engage in repeated confrontations until the output meets the expected criteria ^[1]. Taking MidJourney as an example, when a user inputs the textual description "sunflower field under the starry sky", the system analyzes vast amounts of relevant image features to progressively generate a visual work with balanced composition and layered lighting,

demonstrating the technology's ability to concretize abstract concepts. Diffusion models, on the other hand, employ an inverse denoising principle to gradually transform random noise into a target image. This technique is widely used in DALL-E, enabling the creation of surreal-style paintings, such as scenes that blend classical landscape paintings with cyberpunk elements^[5].

Currently, mainstream AIGC tools hold advantages in creative expression, with significantly faster generation speeds and richer material resources compared to manual creation. Experimental data shows that while a professional designer takes an average of 8 hours to complete a complex illustration, Stable Diffusion can generate 20 optional solutions in just 3 minutes under the same quality requirements^[2]. However, technological limitations persist. When dealing with concepts that are less concrete, such as the prompt "sad geometric shapes", the system often exhibits element cluttering or semantic misunderstandings, resulting in works that lack emotional depth. Tests in the educational field reveal that when students use AI-assisted tools, approximately 65% of their creative proposals exhibit stylistic convergence, particularly in color schemes and shape designs, reflecting inherent algorithmic biases^[3].

Copyright disputes arising during the technological development process warrant attention. The training data for AIGC models is often sourced from publicly available online resources, posing risks of unauthorized use of artists' works. An art education experiment reveals that when specific instructions on a painter's style are input, the similarity between the paintings generated by the system and the original works can reach up to 82%, posing a challenge to the cultivation of originality in art education^[8]. Images generated by tools exhibit defects in expressing physical laws; for instance, when depicting interactive scenes involving multiple figures, there may be misalignments in limb structures. Such errors require timely intervention and guidance from teachers. Despite its shortcomings, AIGC still offers new possibilities for art education, and its rapid iterative nature prompts educators to reconsider the integration path of technological assistance and humanistic qualities^[4].

2.2. Current application status of AIGC in education

Several educational institutions, both domestically and internationally, have attempted to introduce such technologies into classroom teaching, with core values primarily reflected in three aspects: personalization of the learning process, rapid generation of educational resources, and optimization of teaching interaction feedback. A middle school in the United States uses a teaching platform based on generative adversarial networks that can adjust the difficulty coefficient according to students' completion of assignments, enabling course content to match the cognitive level differences among different students.

The obstacles to technological adaptability in educational practice mainly stem from differences in hardware and software configurations. A survey of 15 middle schools in a district of Shanghai indicates that only 53% of the classrooms are equipped with high-performance computers that support real-time rendering, directly affecting the quality and response speed of generated content. The lag in teacher training is also prominent. Data from a teacher training program shows that among teachers who have undergone 20 hours of specialized training, only 65% can independently operate basic functional modules^[9]. Student acceptance is polarized, with technology acceptance model analysis showing that approximately 32% of students are concerned that excessive use may affect the development of their artistic expression abilities, while 48% believe it can effectively assist in creative conception^[10]. These contradictory attitudes reflect that the integration of new technologies into traditional teaching requires a longer adaptation period and the necessity for reforming the supporting evaluation system.

3. Application scenarios of AIGC in middle school art creation teaching

The analysis of AI applications in traditional art teaching, as shown in **Figure 1**, illustrates the utilization and impact of AI-generated content technology in traditional art education. It highlights positive aspects such as providing diverse materials to break through mental frameworks and inspiring creativity through style transfer functions, while also presenting issues like similar compositions, excessive student reliance, and challenges in copyright and originality verification. Furthermore, it emphasizes the necessity for educators to establish norms, noting that the rational use of technology can enhance the diversity of creative proposals, whereas misuse can diminish the distinctiveness of artworks.

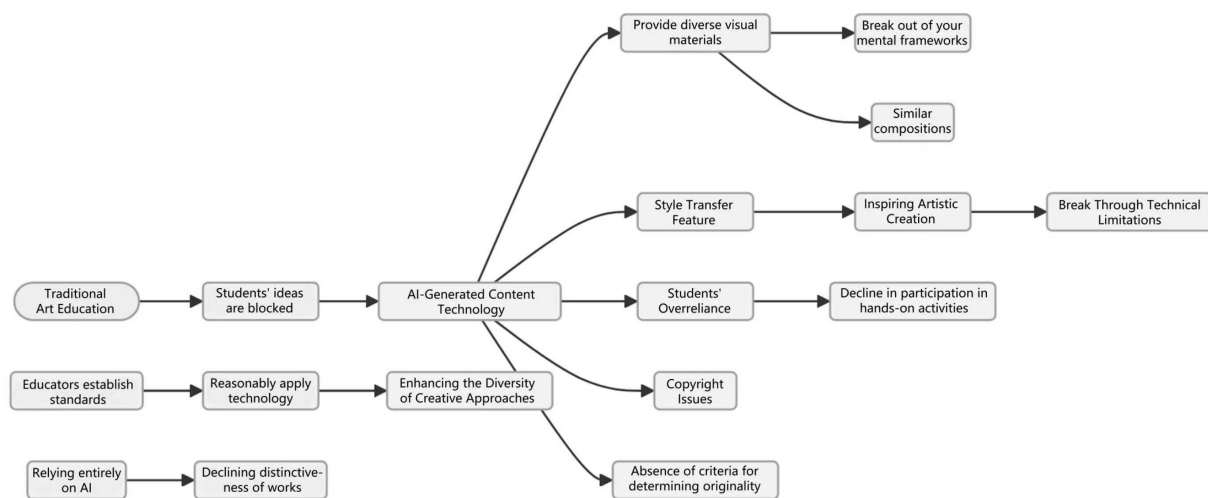


Figure 1. The analysis of AI applications in traditional art teaching

In traditional art education, students often encounter conceptual blocks due to limited experience. AI-generated content technology, leveraging vast image databases and deep learning algorithms, can swiftly produce a variety of visual materials, offering fresh perspectives for creation. Taking DALL-E as an example, upon entering the keyword “future city”, the system generates over thirty proposals, including cyberpunk aesthetics, eco-dome structures, and three-dimensional transportation networks. This instant feedback mechanism effectively breaks down preconceived mental frameworks. A case study from an experimental middle school in a certain city revealed that after using MidJourney for thematic association training, students’ average sketch conception time decreased from 45 minutes to 12 minutes, although 38% of the assignments exhibited similar compositions.

The application of style transfer functions is even more inspiring. In ink painting classes, teachers guide students to combine sketch outlines with the style of Qi Baishi’s works, and AIGC generates intermediate forms that blend traditional charm with modern form. This cross-temporal artistic dialogue has enabled 65% of students to break through the limitations of established techniques. It is worth noting that technological assistance should not entirely replace hands-on practice.

Technological risks also permeate the creative process. When students input specific style commands such as “Van Gogh’s Starry Night”, the generated content often includes unauthorized brushstroke characteristics, raising concerns about training data copyright. A controversy arose during an art festival at a certain school

when a winning work was found to have a 79% similarity to an AI-generated image, exposing the lack of clear standards for originality verification ^[6]. Educators need to establish clear norms, such as restricting the use of AI tools solely for initial inspiration gathering and mandating that final drafts must include more than 60% hand-drawn content ^[9]. Practical experience has shown that classes that reasonably utilize technological assistance experience a 3.2-fold increase in the diversity of creative proposals, whereas classes that rely entirely on AI see a 41% decline in the distinctiveness of their works.

Table 1 illustrates the application of artificial intelligence-generated content (AIGC) technology in art education from various perspectives, including the definitions, typical metrics, magnitudes of change, outcomes or risks, and corresponding intervention measures for each application. Through comparison, the advantages and existing issues of technological application become clear, aiding educators in better leveraging technology while mitigating risks.

Table 1. The application of artificial intelligence-generated content (AIGC) technology in art education from various perspectives

Application Area	Definition	Typical Data/Example	Results & Risks	Intervention Measures
Providing Visual Materials	Using algorithms to generate multi-element materials for creation	Input “future city” yields 30+ concept sketches	Breaks conventional thinking patterns	-
Theme Association Training	Using tools to assist students in brainstorming	Sketch ideation time reduced from 45 min to 12 min	38% of assignments show similar composition	-
Style Transfer	Combining different styles to create new forms	65% of students break through technical limitations	-	-
Manual Practice	Students relying on AI for creation	Watercolor mixing practice participation ↓22%	Over-reliance on AI tools	Master appropriate tool usage
Copyright & Originality	Copyright and originality issues in generated content	79% similarity between student work and AI source	Copyright disputes; lack of originality standards	Establish guidelines; require >60% manual creation in final work
Creative Diversity	Proper use of AI in creation process	Proper use classes show 3.2× more diversity	Full reliance classes show 41% ↓ recognizability	Limit AI to the initial inspiration stage

4. Ethical boundaries and challenges of AIGC applications

The legal status of artificially generated content is currently a subject of significant controversy. Taking art education as an example, when students use Midjourney to generate paintings in the style of Van Gogh, the question of copyright ownership for these works becomes a thorny issue. The European Court of Justice has ruled on AI-generated content, stating that works lacking human intellectual involvement are not eligible for copyright protection, yet Chinese law has yet to establish a clear definition. This legal ambiguity has led to real-world cases in secondary school art classes: for instance, a student’s AI-generated entry in a competition was disqualified due to copyright disputes. The dilemma faced by teachers in practical teaching is the need to both encourage technological innovation and prevent infringement risks.

The copyright issues surrounding training data present an even deeper conflict. Most AI painting tools rely on unauthorized online images for model training, a practice that has sparked multiple class-action lawsuits in Europe and the United States. Getty Images in the US once sued Stable Diffusion for infringing on its image library copyrights, with the case resulting in damages of up to \$150 million. While no commercial disputes have arisen in the field of secondary education, potential risks do exist. When students create secondary works based on AI-generated versions of the Mona Lisa, they may inadvertently use derivative works protected by copyright.

In response to the legal risks in teaching practice, clear guiding principles need to be established. Firstly, the auxiliary role of AI tools should be defined. Following the practice of the Academy of Arts & Design, Tsinghua University, it should be stipulated in the course syllabus that AI-generated content should account for no more than 30%. Secondly, it is essential to enhance copyright literacy education. Some schools in Germany have integrated AI ethics modules into eighth-grade art classes, guiding students on how to properly cite the sources of generated content.

5. Conclusion and recommendations

The study finds that AIGC demonstrates innovative value in middle school art classes. After a middle school in Hangzhou introduced DALL-E to assist teaching in 2023, the number of student works increased by 30% compared to the traditional teaching period, with over 45% of the works showing breakthrough changes in composition. Technological tools can quickly generate visual reference images that combine Van Gogh's style with cyberpunk elements, effectively shortening the time it takes for students to move from the initial spark of inspiration to the formation of sketches. This change has a particularly positive impact on students who lack painting foundations, with classroom participation rising from 52% to 79%. However, some teachers have reported that some students submit generated images directly as their work, sparking controversies over originality standards.

Currently, there is still a lack of regulations on the application of AIGC in the education sector at the policy level. The "Generative AI Education Guidelines" issued by the California Department of Education in the United States in 2023 offer valuable reference, explicitly requiring primary and secondary schools to indicate the level of technical involvement when using AI-generated content. It is necessary to establish an inter-school collaboration mechanism domestically, such as the tiered management system being piloted in Chaoyang District, Beijing, which divides AIGC usage scenarios into three levels: creation assistance, material generation, and work presentation, each corresponding to different levels of technical supervision. In terms of copyright determination, the "dual-track evaluation" system implemented by a key middle school in Shanghai is worth learning from, which divides work evaluation into creativity points and technical points, with the former solely assessing students' original thinking.

The technological adaptability of teachers directly affects the effectiveness of AIGC applications. A 2024 survey of 300 art teachers in the Yangtze River Delta region revealed that only 28% of teachers can accurately distinguish the technical differences between generative adversarial networks and diffusion models. The "AI + Aesthetic Education" training program recently launched by the Guangdong Provincial Department of Education holds demonstrative significance, with participating teachers developing 17 types of AIGC (AI-Generated Content) teaching templates within three months. However, it is crucial to avoid formalizing technical training. In one region, a virtual reality workshop faced excessive equipment failure rates, resulting

in 72% of participating teachers being unable to complete basic operational training. Regularly held technical ethics seminars are even more critical. A middle school in Wuhan significantly enhanced teachers' ability to identify non-original works by 56% through establishing an "AI Plagiarism Case Library."

Course design should emphasize balancing traditional techniques with digital tools. The "Three-Stage Teaching Method" developed by an experimental school in Chongqing has proven viable. In sketching courses, AI usage is restricted to the composition and conception stage, while manual drawing still accounts for over 60% of the work. Regarding tiered guidance, practices at a middle school in Zhejiang demonstrate that linking AIGC access rights to painting proficiency effectively prevents technological abuse. The implementation of a five-tier access system, ranging from "Bronze" to "King", reduced the incidence of technology dependency by 41%. However, it is essential to guard against the psychological pressure caused by excessive tiering. A junior high school in Beijing experienced resistance from 23% of students due to the implementation of a strict access system. The ideal path to achieving human-machine collaboration lies in combining moderately open creative spaces with clear technical usage guidelines.

Disclosure statement

The author declares no conflict of interest.

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Common Problems and Corrective Strategies in Teaching Shooting Postures for Beginners

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Abstract: To improve the accuracy of shooting postures among beginners, it is essential to promptly correct common posture issues during shooting posture instruction. Based on this, this paper analyzes prevalent shooting posture problems among beginners, identifying errors such as incorrect shoulder-rest and cheek-rest positions, improper application of force by both hands, mistimed trigger pulls, irregular breathing patterns, psychological interference, and poor control of the rifle's angle. To address these issues, this paper proposes specific corrective strategies, aiming to enable beginners to maintain accurate shooting postures through targeted training and thereby enhance their shooting precision.

Keywords: Beginners; Shooting posture; Teaching issues; Correction

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1. Introduction

Shooting is a highly technical skill that demands a high level of standardization in the shooter's posture, as the correctness of the posture directly affects shooting accuracy. Especially for beginners, adopting the correct shooting posture not only facilitates rapid entry into the skill but also prevents the formation of incorrect muscle memory due to prolonged inaccurate postures, which can severely hinder the improvement of subsequent shooting skills. Therefore, when conducting shooting posture instruction for beginners, coaches should analyze prevalent shooting posture issues among beginners and, based on this analysis, explore effective strategies to correct their erroneous shooting postures. They should scientifically design targeted shooting training to enhance the effectiveness of shooting posture instruction while helping beginners more solidly master shooting skills^[1]. This paper analyzes common problems in beginners' shooting postures and proposes specific corrective teaching strategies aimed at improving beginners' shooting proficiency.

2. Common problems in beginners' shooting postures

2.1. Shoulder-rest and cheek-rest

The accuracy of shoulder-rest and cheek-rest positions during rifle shooting is closely related to shooting precision. However, some beginners often encounter issues with shouldering and cheek-resting during rifle shooting (such as having the shoulder rest position too low or too high). Both a shoulder rest position that is too low or too high can cause bullets to deviate from the bullseye. Additionally, improper cheek-resting pressure can also affect shooting accuracy. If the pressure is too great, it may cause the head's position against the firearm to change, resulting in a shift of the aiming line and causing bullets to deviate to the left and high of the bullseye. On the surface, these errors may seem minor, but they can significantly impact shooting performance ^[2].

2.2. Pistol force application

During pistol shooting training, beginners are prone to experiencing an imbalance in grip strength. Some beginners, in an attempt to prevent the firearm from shaking, grip it too tightly, causing stiffness in the wrist and tension in the arm muscles, which severely affects the stability of the grip and can lead to frequent swaying of the firearm's muzzle. Each shooting posture differs, causing bullets to scatter and making it difficult to form a concentrated shooting area. On the other hand, some beginners grip the firearm with insufficient strength, resulting in noticeable shaking of the firearm after raising it, making it difficult to aim steadily. Moreover, when pulling the trigger, they may easily experience "trigger dragging" due to insufficient strength, exacerbating the firearm's shaking and significantly reducing shooting accuracy.

2.3. Incorrect timing of trigger pull

Mastering the timing of the trigger pull is also a crucial aspect of shooting posture instruction, but some beginners often struggle to accurately grasp the right moment. Some beginners, in an attempt to precisely capture the aiming point, often force a trigger pull at an inappropriate time or jerk the trigger. At this moment, the aiming line often has not yet steadily pointed at the aiming point, making it difficult for the bullet to reach the intended location ^[3]. Jerking the trigger is a major mistake in shooting, as it causes the firearm to shake significantly instantaneously, further destabilizing the already unstable aiming line and inevitably causing the bullet to deviate from the bullseye.

2.4. Disrupted breathing rhythm

In shooting posture instruction, many beginners struggle with improper control of their breathing rhythm. When shooting, they stop breathing too early, and under the influence of prolonged breath-holding, their muscles involuntarily tremble. This severely affects the stability of holding the gun, making it impossible to maintain the correct posture for aiming. It may even lead to jerking the trigger involuntarily due to muscle tremors, causing the bullet to deviate from the target center.

2.5. Psychological interference

Psychological factors significantly interfere with shooting accuracy for beginners. Many beginners, when shooting, may become overly concerned about shooting accuracy, trigger timing, etc., leading them to make incorrect movements (such as frequent blinking, shrugging, etc.). This results in incorrect shooting postures, loss of gun stability, and consequently, reduced shooting accuracy. For example, a beginner during shooting training, due to excessive concern about their shooting performance, blinked and shrugged involuntarily when

pulling the trigger, causing the bullet to deviate from the target center^[4].

2.6. Incorrect gun plane angle

The accuracy of the gun plane angle in shooting directly affects shooting precision. However, beginners often tilt the gun plane to the left or right when shooting, reducing the angle of fire and causing the axis of the gun barrel to deviate from its intended direction. This results in the actual point of impact being to the left or lower right of the expected position. To improve the shooting accuracy of beginners, sufficient attention must be paid to correcting this issue in shooting posture instruction.

3. Corrective strategies in shooting posture instruction for beginners

3.1. Correcting the shoulder-to-cheek posture

When instructing beginners on rifle shooting postures, coaches need to emphasize correcting incorrect shoulder-to-cheek postures. Firstly, guide beginners to align the center of the rifle's buttplate with the "triangular area" formed by the shoulder joint and clavicle connection. The area where the buttplate contacts the body should be larger than the size of a palm. Secondly, gently push the body of the rifle with both hands. If the recoil is primarily transmitted to the junction of the shoulder and chest without causing significant localized tenderness, it indicates that the posture is correct. If there is a stinging sensation in the shoulder or if the clavicle is compressed, adjustments of 1 to 2 centimeters upward or downward should be made. Finally, the coach should fully leverage their role as a supervisor, standing beside the beginner to observe whether the axis of the body's spine and the rifle's buttstock maintains a 30° to 45° angle, or whether the arm, when fully extended, aligns with the axis of the buttstock, preventing the buttstock from "buckling inward" or "tilting outward." When correcting the cheek weld posture, instruct the beginner to follow the basic principle of "gentle leaning and light contact", naturally lowering the head so that the cheek gently touches the cheek rest of the buttstock. The pressure of contact should be such that "the cheek rest can be felt, but there is no sense of compression"^[5]. During instruction, the coach can organize beginners to conduct closed-eye rifle-raising drills. After the cheek is in contact with the rifle's buttstock cheek rest, the beginner should open their eyes to observe the sight line. If the deviation of the sight line is within 2 millimeters, it indicates a stable cheek weld. If there is a significant deviation, the coach can guide the beginner to attach anti-slip tape to the cheek rest to assist in securing the head.

3.2. Correction of handgun firing posture

When teaching firing postures, coaches should emphasize single-handed straight-arm gun-holding drills, instructing beginners to fully press the palm of their right hand against the pistol grip, with fingers naturally wrapped around it and the index finger lightly resting on the trigger. The grip strength should be such that the gun can be held steadily without significant wrist trembling, and the finger pressure should be evenly distributed. At the same time, instruct the beginner to effectively control the direction of force, exerting force backward along the axis of the barrel, keeping the wrist and arm in a straight line, and concentrating the force at the junction of the wrist and palm. The wrist should not be turned outward or inward. During the beginner's training, the coach should supervise closely and promptly correct any wrist deviations.

Additionally, in teaching, the coach should also organize beginners to strengthen muscle balance training, utilizing methods such as "gun-holding relaxation cycle drills" to enhance the beginner's ability to control their

muscles. Instruct beginners to hold the gun steady for 30 seconds after raising it and then put it down, followed by fist-clenching and stretching exercises to relax the shoulder and forearm muscles. Then, have them raise the gun again while guiding them to appropriately reduce the grip strength on the gun and gradually find the balance point between gun stability and muscle relaxation. Additionally, coaches can organize beginners to engage in light-weight resistance training by hanging a relatively lightweight sandbag at the front end of the gun barrel to enhance the beginners' arm and wrist control as well as muscle endurance ^[7].

3.3. Precisely grasping the trigger-pulling timing

In teaching beginners shooting postures, coaches need to explain to them that it is normal for the gun barrel to experience slight shaking due to interference from heartbeats and breathing when raising the gun. The purpose of raising-the-gun training is not to eliminate this shaking but to aim according to the trajectory of the gun barrel's shaking and precisely grasp the trigger-pulling timing. When organizing beginners for training, coaches can use video recording equipment to capture the trajectory of the muzzle's shaking when the beginners raise the gun, helping them understand and remember the shaking pattern of their own gun barrels during the process, thus providing a reliable basis for controlling the trigger-pulling timing. Subsequently, coaches can organize beginners to conduct staged trigger-pulling training. In the first stage, guide beginners to use a fixed gun mount to stabilize the gun barrel and then conduct "aiming, pre-pressing the trigger, and pulling the trigger" exercises, allowing them to feel the trigger travel. In the second stage, instruct beginners to raise the gun, aim when the shaking trajectory is within an effective range, and slowly pull the trigger to fire. In the third stage, coaches can use the "1-2-3-pull" command to assist beginners in conducting 3-second aiming and 1-second trigger-pulling training, helping them gradually develop muscle memory for grasping the trigger-pulling timing. For beginners who make mistakes in actually grasping the trigger-pulling timing, coaches need to strengthen corrective training. For example, for beginners who "wait too long", coaches can use a stopwatch to time them, requiring them to complete the trigger-pulling within 5 seconds after raising the gun to prevent muscle fatigue from affecting the hit rate. For beginners who "pull the trigger hastily", coaches can stick red dots next to the aiming point to remind them to slowly pull the trigger only after aiming, appropriately extending the preparation time for pulling the trigger ^[8].

3.4. Accurately control breathing rhythm

When correcting the posture issues of beginners in shooting stance instruction, coaches need to facilitate accurate control of breathing rhythm through breathing training ^[9]. During training, before beginners raise their guns, they should be guided to breathe naturally, avoiding breath-holding or deep breathing, to keep the body relaxed. When aiming with the gun raised, beginners should be instructed to expand their chest while inhaling, which may cause the sight line to move slightly upward, and contract their chest while exhaling, which may cause the sight line to move slightly downward. Through repeated training, beginners can be encouraged to accurately control their breathing rhythm and be guided to fire when exhalation is nearly complete but before inhalation begins, as the body is relatively stable at this moment, making it an ideal time for firing. Additionally, beginners should be instructed to maintain their stance for 1 to 2 seconds after firing before breathing again, preventing body sway due to premature breathing and thereby affecting subsequent precise shooting. Furthermore, coaches should organize breathing adjustment training for beginners in different scenarios. For example, in close-range shooting breathing rhythm control training, beginners should be guided to appropriately

shorten their breath-holding time by 1 to 2 seconds, without overdoing it to avoid tension caused by breath-holding. In medium- to long-range shooting training, beginners should be instructed to appropriately extend their exhalation time before breath-holding (typically 3 to 4 seconds) to stabilize the chest.

3.5. Overcome distractions

In shooting stance instruction for beginners, addressing “superfluous” movements caused by psychological factors, coaches need to correct the beginners’ mindset and guide them to overcome distractions, focusing their attention on aligning the front sight and rear sight before firing, rather than thinking about “whether they can hit the 10-ring” or “whether the gunshot will be loud” ^[10]. During instruction, coaches can organize beginners to conduct “blind aiming training”, where they raise their guns with their eyes closed and then open them to check if the front sight is aligned with the rear sight. If not, immediate adjustments should be made. Through repeated training, beginners can develop an “aiming priority” mindset. Meanwhile, coaches should also organize desensitization training for beginners to eliminate unnecessary movements. For beginners who exhibit “shoulder shrugging”, during rifle-raising drills, a pencil can be placed on their shoulders. When they shrug, the pencil will fall, serving as a prompt to correct their rifle-raising posture. For beginners with the unnecessary movement of “blinking”, during training, they can be required to wear goggles with a piece of transparent tape affixed to the inside. When they blink, they will touch the tape, thereby correcting the issue of frequent blinking. Additionally, when coaches are instructing beginners on shooting postures, they should guide beginners not to blindly pursue hitting the 10-ring target at the beginning. Instead, they should set the goal as “achieving standard shooting movements without unnecessary actions and having bullet impacts concentrated in the 8-ring area.” By achieving these smaller goals, beginners can build confidence in their learning.

3.6. Pay attention to the rifle’s plane angle

In shooting posture instruction, coaches need to guide beginners to check the levelness of the rifle’s plane in real time. For rifles, beginners can be instructed to use the crosshair of the sight for inspection. If the horizontal line of the target paper is parallel to the horizontal line of the crosshair and the vertical line of the target paper is parallel to the vertical line of the crosshair, it indicates that the rifle’s plane is level. If there is a tilt, adjustments need to be made to the grip angle of the right hand or the height of the left hand’s support. For handguns, beginners can be instructed to check by observing the relationship between the arm and the axis of the barrel. If the two are aligned in the same direction and the side of the gun is perpendicular to the ground, it indicates that the rifle’s plane is level. Alternatively, beginners can be instructed to affix a vertical sticker to the side of the gun and judge the levelness of the rifle’s plane by observing the relationship between the sticker and the vertical line of the target paper.

When instructing beginners on standing shooting, guide them to keep their feet apart at a width equal to their shoulders and maintain their body’s center of gravity in the middle. If the center of gravity shifts, it may cause the rifle’s plane to tilt. When instructing on prone shooting, guide beginners to keep their abdomen in contact with the ground, with their feet apart at a width equal to their shoulders, and their toes pressing against the ground. The grip height of the right hand should be consistent with the support height of the left hand, without one being higher or lower than the other.

During teaching, instructors can use a “level calibrator” for gun-raising exercises, guiding beginners to adjust the angle of the gun’s surface based on the actual display of the level. They can also organize “target-

adhesion” training for beginners, where an A4 paper is attached to the side of the target paper. When raising the gun, the side of the gun’s body needs to be close to the A4 paper. If the two are completely aligned, it indicates that the gun’s surface is level; if there is a gap between them, adjustments to the gun-raising posture need to be made promptly until they are perfectly aligned.

4. Conclusion

In summary, when teaching beginners shooting postures, instructors must recognize the impact of factors such as shoulder-to-cheek contact, hand force application, trigger timing, breathing rhythm, psychological state, and gun surface angle on the standardization of shooting postures and shooting accuracy. Based on the characteristics of beginners, they should design teaching strategies for correcting shooting postures from dimensions such as standardizing shooting movements, forming correct muscle memory, and psychological adjustment. By utilizing phased training, auxiliary tools, and scientific guidance, they can gradually correct the incorrect shooting postures of beginners. At the same time, they should pay attention to the interference of psychological factors on beginners’ shooting and use positive reinforcement and specialized training to help them build learning confidence. Additionally, instructors need to continuously optimize their teaching methods to enable beginners to accurately grasp the essentials of shooting postures, thereby laying a solid foundation for their subsequent improvement in shooting skills.

Disclosure statement

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Research on the Quality Monitoring System of “Student-centered” Professional Teaching under the Background of Artificial Intelligence: Taking the Computer Application Major as an Example

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Abstract: In response to the problem of “emphasizing results over processes” and “emphasizing teachers over students” in the teaching quality monitoring of computer application majors in vocational colleges, this paper takes “student-centered” as the core concept, combines artificial intelligence technology to construct a “goal process evaluation improvement” closed-loop system, and innovates the “course course integration” skill connection mechanism. Empirical evidence shows that after the implementation of the system, the achievement rate of students’ core skills has increased by 8.3%–12.5%, and their learning satisfaction has increased by 13.6%–18.4%. The research provides a replicable educational reform path for monitoring the teaching quality of vocational engineering majors.

Keywords: Artificial intelligence; Student-centered; Teaching quality monitoring; Computer application major

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1. Introduction

Promoting digitalization of education is a clear direction for the development of vocational education. As a core engineering major, the teaching quality of computer applications directly affects students’ ability to adapt to the IT industry. However, there are obvious shortcomings in the current monitoring system: the efficiency of manual correction of programming courses is low, and it is difficult to provide timely feedback on code errors; Project development involves multiple courses but lacks skill continuity monitoring; The evaluation indicators focus on teacher behavior and ignore students’ learning experience and job requirements^[1]. Artificial intelligence technology, such as automatic code detection and classroom behavior analysis, provides support for solving pain points. Therefore, building an AI empowered “student-centered” monitoring system has become a key direction for improving teaching quality in this major.

2. Related theoretical foundations

The core theoretical support of this study focuses on three points: firstly, the concept of “student-centered”, emphasizing the monitoring core of students’ skill growth and learning experience, such as setting hierarchical goals based on differences in programming foundations; The second is the theory of Total Quality Management (TQM), which emphasizes “whole process” monitoring and covers pre class preparation to internship training; Thirdly, AI empowers educational theory, relying on AI to achieve automatic collection and intelligent analysis of teaching data, such as code quality inspection and skill growth tracking ^[2]. The integration of the three provides a theoretical framework of “student orientation + technical support + process standardization” for system construction.

3. Principles for constructing a “student-centered” teaching quality monitoring system in the background of artificial intelligence

3.1. Student-centered principle: Anchoring personalized needs and strengthening student participation

Based on the learning patterns and growth needs of students majoring in computer applications, a monitoring logic of “student participation and student benefit” is constructed. On the one hand, indicator design focuses on student experience and development, such as incorporating “perceived difficulty of programming tasks” and “job skill adaptation needs” into core indicators. On the other hand, establishing a diversified student participation mechanism: developing an “intelligent feedback platform”, where students can submit teaching suggestions in real time (such as difficulty feedback on programming cases), and teachers adjust teaching cases based on feedback to ensure that monitoring meets the real needs of students.

3.2. Intelligent empowerment principle: Deepen the adaptation of technology scenarios and improve monitoring accuracy

Design a dedicated AI monitoring module to achieve deep integration of technology and teaching scenarios, based on the teaching characteristics of “programming as the main focus and project-driven” in computer application majors. One is the AI monitoring of programming courses, which integrates the SonarQube code quality inspection tool to automatically calculate “syntax error rate, code repetition rate, and comment completeness.” The AI generates a correction report within 5 minutes, and teachers can provide targeted explanations without manual correction, improving efficiency by more than 80%. The second is project practice AI tracking, which monitors the project connection of courses such as “Web Page Production”, “Front end Framework”, and “Database Principles” in real time: records the entire process data of students from “static web page development” to “dynamic interaction implementation” and then to “database docking”, and AI automatically analyzes the “project progress deviation rate.” The third is classroom AI interaction optimization, which analyzes students’ “programming focus” (keyboard typing frequency, screen focus time) through computer vision technology. When the focus is below 70% (such as staying on non-programming pages for a long time), the system automatically pushes “interactive reminders” to the teacher, and the teacher can activate the classroom through “code debugging competition” and “real-time questioning” to avoid students falling into

“hidden distraction” due to programming difficulties.

3.3. Full process closed-loop principle: Covering the entire teaching chain to avoid monitoring breakage

Following the closed-loop logic of “goal setting process monitoring evaluation feedback continuous improvement”, ensure that there are no monitoring blind spots in all aspects of computer application teaching. Pre-class focus on “resource and design adaptation”: the intelligent platform reviews teaching designs, and designs that do not meet the standards need to be reoptimized. In class, emphasis is placed on “dynamic data collection”: relying on smart classrooms and programming platforms, real-time behavior data (attendance rate, teacher-student interaction frequency) and achievement data (classroom test scores, code error rates) are captured, and AI real-time statistics of error situations are used to remind teachers to adjust their teaching focus. After-class reinforcement of “skill consolidation tracking”: For unqualified students, automatically push the “one-on-one tutoring appointment link.” For example, if students are exposed to “insufficient cloud server deployment capabilities” during their studies, teachers can supplement relevant cases in the subsequent “Software New Technology” course to form a “monitoring improvement” cycle.

3.4. Professional adaptation principle: Emphasize engineering skills orientation and fit professional characteristics

Design differentiated monitoring indicators and methods based on the engineering and practical characteristics of computer application majors. In terms of skills, focus on professional core competencies: take “code writing standardization (syntax error rate $\leq 5\%$)”, “project development cycle (in line with enterprise working hours standards)”, and “problem-solving ability (bug fixing time ≤ 2 hours)” as core indicators. For example, in programming courses, AI automatically detects code standardization, and those that do not meet the standards need to be revised. In terms of adapting teaching modes, special monitoring is conducted for project-based teaching design: monitoring “team collaboration efficiency (code merging conflict rate $\leq 10\%$)” and “task allocation rationality (each person undertakes core modules accounting for $\geq 30\%$).” For example, in the “Comprehensive Project Training”, AI tracks the “code submission frequency and communication records” of team members and pushes the “Agile Development Collaboration Guide” to teams with conflict rates exceeding 15%. At the level of industry integration, closely following the standards of professional qualification certificates and job requirements: breaking down the “responsive layout implementation” and “front-end engineering” requirements of the Web front-end development certificate into monitoring indicators for the “Front end Framework Application” course; By using AI to capture IT recruitment data, dynamically adjust monitoring focus — when the proportion of Python demand increases from 25% to 32%, increase the monitoring weight of “Automated Script Development” in the “Python Programming” course to ensure that monitoring is in line with industry technological iterations^[3].

3.5. Principle of multi-party collaboration: Integrate cross-subject resources to ensure comprehensive monitoring

Build a four-dimensional collaborative monitoring network consisting of students, teachers, enterprise experts, and teaching managers, with clear responsibilities and complementary weaknesses among all parties involved. Students focus on “learning experience evaluation” and evaluate “adaptability of teaching content” and “timeliness of feedback” through questionnaires. For example, after the course of “Web Design”, students score

“practicality of HTML cases.” If the score is below 3 points (on a 5-point scale), the case will be adjusted ^[4]; Teachers focus on “teaching self diagnosis and process evaluation”, combined with “student learning data” (such as code progress rate) and “classroom performance” scoring, while conducting teaching reflection (such as “whether asynchronous programming explanation is clear”); Enterprise experts provide “industry suitability evaluation”, and evaluate student works from “code standardization and functional practicality” through the “project evaluation system.” For example, an Internet enterprise evaluates the “campus library management system” as “reasonable database design, but interface interaction needs optimization”, and feedback is directly used for curriculum improvement; Teaching managers supervise the compliance of monitoring processes, check the authenticity of evaluation data (such as whether teachers have tampered with student grades), and implement improvement measures (such as adjusting teaching for high code error rates). For example, in the evaluation of graduation projects, four-dimensional entities collaborate and participate: students self-evaluate the “module contribution”, teachers evaluate the “code quality”, enterprise experts review the “industry adaptability”, and managers check the “process compliance” to ensure comprehensive and objective monitoring.

4. The construction path of the “student-centered” professional teaching quality monitoring system in the background of artificial intelligence

4.1. Goal-setting module: Dual-oriented hierarchical goals, dynamically adapting to requirements

Based on the dual orientation of “student foundation + industry demand”, establish a three-level goal system. The first level goal is graduation requirements, benchmarking IT industry job skills — website development requires mastery of “HTML/CSS/Vue 3, MySQL index optimization”, software testing requires mastery of “Selenium tools, test case design.” The secondary objective is the course module objective, which breaks down the graduation requirements into three major modules: basic (“Introduction to Programming Languages”), core (“Front end Framework Applications”), and practical (“Comprehensive Project Training”); the basic module requires “85% of students to master grammar”, the core module requires “75% of students to reach the basic development level of enterprises”, and the practical module requires “90% of students to complete industry standard projects.” The third-level goal is a personalized learning objective, formulated through entrance programming tests and career research — the goal for students with weak foundations in “Web Making” is “static web development (grammar error rate $\leq 8\%$)”, and the goal for advanced students is “responsive development (compatible with Chrome, Firefox, Edge browsers).”

At the same time, establish an AI dynamic calibration mechanism: crawl IT job data from BOSS direct recruitment, intelligent recruitment and other platforms through web crawlers every month, analyze the “proportion of programming language demand” and “popularity of framework skills” (such as Vue3 demand growth exceeding Vue2), and adjust core course objectives; Every semester, 10 cooperative enterprises (such as local Internet companies) are invited to participate in the “goal calibration meeting”, and the practice module goals are optimized in combination with enterprise project cases (such as e-commerce platform development) to ensure that the goals and industry technology iterations are the same frequency ^[5].

4.2. Process monitoring module: AI + course integration, achieving invisible monitoring

In the pre-class preparation stage, the focus is on monitoring the adaptability of resources and designs: the intelligent platform is connected to the “teaching resource library”, AI automatically detects the timeliness of

resources, and alerts teachers to update outdated resources; Develop an “Intelligent Review System for Teaching Design” to review lesson plans based on “goal stratification and task differentiation”, and return and modify lesson plans that do not meet the standards.

In the classroom teaching stage, achieve intelligent collection of multi-modal data and integration of classes and lessons: on the one hand, collect behavioral data (attendance rate, focus) and achievement data (classroom test scores, code error rates), and AI generates real-time “classroom quality reports”; On the other hand, innovating the mechanism of “leading course works+follow-up course development” — the final work of “Web Page Production” (leading course) is a “static personal blog”, which needs to pass AI detection (grammar error rate $\leq 5\%$) before entering “Front end Interface Design” (follow-up course); Front end Interface Design optimizes static web pages into “responsive interfaces”, using the work as the foundation for the development of “Front end Framework Applications.” The intelligent platform records the iteration data of the work, forming a “skill growth map.”

In the post class practice stage, track skill consolidation and project progress: the online platform monitors the “quality of homework completion”, AI identifies student situations and pushes tutoring resources; For the Comprehensive Project Training, real-time monitoring of progress, quality (AI weekly code detection), collaboration (code submission frequency, conflict rate) indicators, and real-time warning of lagging projects.

4.3. Evaluation feedback module: Multi-element collaboration + precise push

Build a four-dimensional evaluation system of “student teacher enterprise manager”, clarify the weights and contents of each subject: student self-evaluation and peer evaluation account for 30%, teacher process evaluation accounts for 25%, enterprise expert evaluation accounts for 25%, and manager supervision evaluation accounts for 20%.

At the same time, establish a precise feedback mechanism: the intelligent platform generates monthly “skill growth reports” for students, clarifying “weak links (such as insufficient communication in Vue components)” and “improvement suggestions (learning component value transfer cases)”; Hold monthly feedback symposiums to address common issues such as high difficulty in programming assignments ^[6].

5. Conclusions and prospects

The AI-enabled “student-centered” monitoring system constructed in this study effectively solves the monitoring pain points of computer application majors through student-centered design, intelligent technology adaptation, and a full process closed-loop, significantly improving students’ skill achievement rate and learning satisfaction. In the future, it is necessary to introduce big language models to improve the accuracy of AI diagnosis, jointly build “enterprise-level monitoring standards” with enterprises, and promote the implementation of the system in more engineering majors.

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Author contributions

Dongxing Wang conceived the idea of the study and wrote the paper.

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Research on the Exploration and Practical Path of Aesthetic Education Infiltration in the Higher Vocational Architecture Interior Design Major under the “Dual-Subject, Three-Stage, Three-Integration” Model

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Abstract: This study innovatively constructs a “dual-subject, three-stage, three-integration” model for aesthetic education infiltration, leveraging a deep school-enterprise collaboration mechanism to effectively bridge the aesthetic gap between education and industry. Through a layered and progressive cultivation strategy, it promotes a spiral escalation in achieving aesthetic education goals. Additionally, by employing full-scenario infiltration methods, it successfully creates a virtuous ecosystem where “professional education is equivalent to aesthetic education.” Practical validation demonstrates that this model effectively addresses challenges such as fragmentation, superficial collaboration, and inefficient infiltration in aesthetic education within the architecture and interior design major. It significantly enhances students’ aesthetic abilities, cultural literacy, and social responsibility, showcasing substantial potential for widespread promotion.

Keywords: Dual-subject; Three-stage; Three-integration; Aesthetic education infiltration; Architecture interior design major

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1. Introduction

Against the backdrop of the “New Liberal Arts” initiative advocating interdisciplinary integration and the “Double High Plan” in vocational education focusing on cultivating high-quality talent, the architecture interior design major is strategically positioned at a pivotal juncture, transitioning from a “skill-oriented” to a “literacy-oriented” approach. This shift is not only an inevitable trend in industry development but also a crucial direction

for educational innovation. Currently, the modern interior design industry has transcended the limitations of merely creating functional spaces and is instead pursuing a profound integration of “spatial aesthetics, technological innovation, and humanistic care.” This transformation imposes stricter requirements on designers, demanding not only exquisite professional skills but also profound cultural connotations, keen aesthetic insight, and a strong sense of social responsibility. However, when examining the current aesthetic education practices in the field of architectural interior design, a host of issues have emerged: the objectives of aesthetic education are fragmented, often existing mainly in the form of independent public art courses with loose connections to core professional courses; school-enterprise collaboration remains superficial, with corporate involvement mostly limited to internship arrangements and project visits, making it difficult to deeply integrate cutting-edge industry aesthetic standards into the curriculum; cultural inheritance is also confined to a superficial level, with the use of regional architectural cultural symbols often involving simple imitation and lacking modern transformation and innovation. These issues frequently result in students’ design works falling into the dilemma of being “technically competent but aesthetically inadequate” or “conceptually novel yet culturally deficient”, making it difficult to meet the industry’s demand for versatile talents. In light of this, guided by the educational philosophy of “integrating the five areas of education”, this study constructs a “dual-subject, three-stage, three-integration” aesthetic education immersion model, aiming to effectively address the issue of professional education and aesthetic education being disjointed through deep school-enterprise collaboration, hierarchical and progressive training, and full-scenario immersion, thereby providing new insights for cultivating high-quality technical and skilled talents in architectural interior design.

2. Definition of core concepts and theoretical foundations

Dual-subject collaboration: In the professional talent cultivation system, implementing a dual-subject collaborative education model is of paramount importance. By taking schools and enterprises as the two core educational entities, a complete closed loop of “theory input—practice transformation—value feedback” is constructed. Schools are responsible for building aesthetic theories, cultural inheritance, and foundational skill development; enterprises provide practical scenarios, industry aesthetic standards, and professional competence training. Their deep collaboration effectively breaks down the aesthetic barriers between education and industry.

Three-stage progressive training: For the cultivation of talents in architectural interior design, the three-stage progressive training model aligns with students’ cognitive patterns. Following the logic of “perceiving beauty—expressing beauty—creating beauty”, the talent cultivation cycle is divided into three stages. The foundational stage (freshman year) focuses on constructing spatial aesthetic cognition and cultivating cultural sensitivity; the empowerment stage (sophomore year) strengthens aesthetic expression and promotes interdisciplinary integration; the innovation stage (junior year) pursues aesthetic innovation and achieves social value, demonstrating a spiral upward progression.

Three-integration infiltration strategy: In the aesthetic education of the architectural interior design major, the “Three-integration infiltration strategy” holds significant value. This strategy constructs a comprehensive aesthetic education system spanning the “knowledge layer—application layer—environmental layer.” Professional course integration involves delving into the aesthetic elements of core courses to achieve resonance between knowledge transmission and aesthetic cultivation. Practical integration utilizes real projects as carriers for aesthetic education to enhance aesthetic application capabilities. Campus integration creates an immersive environment to achieve a subtle aesthetic influence.

3. Deconstruction of the current situation and problems in aesthetic education in architectural interior design

3.1. Practical dilemmas in professional aesthetic education

In the cultivation of professionals in architectural interior design, multiple aesthetic education dilemmas urgently need to be resolved. In terms of subject collaboration, vocational colleges have formulated talent demands that are not closely linked^[1]. School-enterprise cooperation often gets stuck in superficial interactions such as “project visits—internship assignments”, failing to establish an effective aesthetic education collaboration mechanism. There is poor alignment between corporate aesthetic standards and commercial design logic with the school’s curriculum system, leading students to tend toward “conceptual aesthetic expressions” in course designs. However, upon entering corporate practice, their proposals often struggle to materialize due to neglecting client budgets and functional requirements, resulting in a severe disconnect between “school aesthetics” and “industry aesthetics.” Seventy percent of students report that the aesthetic knowledge learned in class is difficult to apply to commercial projects. In terms of stage connection, aesthetic education lacks progression, presenting a gap characterized by “heavy theory in lower grades and heavy technology in higher grades.” Aesthetic education courses are concentrated in the freshman year’s public foundation stage, with subsequent core professional courses lacking progressive aesthetic training modules. Although senior students master complex design software and construction techniques, they are weak in deep aesthetic dimensions such as cultural narration and emotional expression. Only 30% of graduation projects effectively incorporate cultural elements. At the level of immersion effectiveness, the integration of aesthetic education with professional education is insufficient, presenting a state of “two separate entities.” Professional course teaching emphasizes technical principles and operational norms while neglecting the exploration of aesthetic elements. For example, “Architectural Decoration Materials and Construction” fails to analyze the aesthetics of materials and the beauty of structural forms, and “CAD Drawing” overlooks guidance on the “orderly beauty of lines” and the “logical beauty of layout.” In practical teaching, 60% of institutions do not include aesthetic innovation and cultural expression in training assessment indicators, resulting in student works that meet technical standards but lack humanistic connotations.

3.2. Analysis of deep-seated constraints

In the process of promoting aesthetic education in the field of architectural interior design, two major issues have emerged in the areas of faculty and evaluation. Regarding faculty structure, there is a significant imbalance. Most professional teachers have backgrounds in architectural engineering or design technology but lack knowledge in art history, aesthetics principles, and other related fields, making it difficult for them to effectively integrate aesthetic education content into professional courses. While enterprise mentors possess rich practical experience, they lack the support of educational theories, focusing more on technical details and commercial implementation during guidance, while neglecting the cultivation of aesthetic thinking and cultural literacy. Only 20% of institutions have formed interdisciplinary aesthetic education teams consisting of “professional teachers + art teachers + enterprise mentors”, resulting in a “double loss of voice” for aesthetic education in both knowledge transmission and practical transformation. In terms of the evaluation system, the current framework is primarily dominated by technical indicators, with aesthetic literacy and cultural connotations being marginalized. In course assessments, technical indicators account for up to 70%, while dimensions such as the cultural fit of design solutions lack scientific evaluation criteria and quantitative

indicators. This “heavy emphasis on technology and light emphasis on aesthetics” orientation leads students to overlook the enhancement of their aesthetic and cultural literacy.

4. Systematic construction of the “dual-subject, three-stage, three-integration” model

4.1. Innovation of the dual-subject collaborative education mechanism

In the practical process of cultivating talents in architectural interior design, schools and enterprises, as the two core educational entities, need to establish a closely collaborative and complementary education mechanism. By introducing the concept of “co-creation in teaching”, they can jointly develop cultural and creative product projects through in-depth collaboration between the two entities, achieving the integration of teaching and industrial practice^[2]. This approach aims to form a comprehensive, multi-level collaborative educational synergy that drives the high-quality development of professional education.

From the perspective of the school as the main entity, efforts should be made to construct a dual-driven aesthetic education system that combines “curriculum + culture.” In terms of professional curriculum development, aesthetic education elements should be deeply explored, and a mechanism of “one core course, one aesthetic education main thread” should be established. For example, in “Principles of Interior Design”, the core focus could be on “spatial narrative aesthetics”, explaining methods for creating emotional spaces through materials, lighting, and color; in “Ergonomics”, a special topic on “aesthetic design of barrier-free facilities” could be embedded; and in “Soft Furnishing Design”, a module on “extraction and application of regional cultural symbols” could be set up to cultivate students’ cultural translation abilities. In terms of creating an aesthetic ecology on campus, a “three-dimensional aesthetic education field” will be established. At the physical space level, a Material Aesthetics Gallery, a Design Master Studio, and a Regional Architectural Culture Corridor will be constructed. At the cultural activities level, relevant forums, workshops, and exhibitions will be organized. At the digital platform level, an “AR Art Guide” system will be developed to provide immersive aesthetic cultivation.

Enterprises, on the other hand, are required to build a practical education platform based on “projects + standards.” By integrating real projects such as commercial space renovations, elderly-friendly residential designs, and rural homestay upgrades undertaken by enterprises into the teaching system, students can deeply participate in all aspects of project practice. From the demand research phase, students are guided to understand clients’ aesthetic preferences and lifestyle habits; in the design phase, they are encouraged to incorporate industry trends and cultural elements; and during the construction phase, they are required to strictly control material aesthetic effects and craftsmanship details. Meanwhile, enterprise mentors should evaluate students comprehensively and multi-dimensionally using core indicators such as “aesthetic fit”, “commercial viability”, and “cultural expression”, thereby effectively enhancing students’ practical skills and aesthetic literacy.

4.2. Design of a three-stage progressive training system

In the training system for architectural interior design professionals, aesthetic education planning at different stages is crucial.

The Foundational Stage (from freshman year to the first semester of sophomore year) focuses on building aesthetic cognition and cultural decoding abilities. This ability involves deeply understanding history, culture, and local spirit, and creatively transforming them into design languages and products that align with modern aesthetics and market demands^[3]. In terms of course teaching, practical tasks such as “3D modeling of classic cases” (e.g., light and shadow analysis of I.M. Pei’s Suzhou Museum) and “aesthetic mapping of historical

districts” are used to strengthen students’ perception of formal aesthetic principles such as proportion and scale. In practical activities, “digital collection of traditional architectural patterns” is organized, where students use PS/AI to extract traditional decorative symbols and build a database of regional cultural elements, laying a solid foundation for subsequent design transformations.

The Empowerment Stage (from the second semester of sophomore year to junior year) emphasizes aesthetic expression, innovation, and interdisciplinary integration, with the core task of breaking through single technical thinking and achieving design translation that combines “function + aesthetics + culture.” Through organizing workshops on themes such as “intangible cultural heritage-themed homestay design” and “application of color psychology in children’s spaces”, knowledge from disciplines like anthropology is introduced to analyze the aesthetic and emotional needs of different groups. For instance, in the “intangible cultural heritage-themed homestay design” workshop, students integrate intangible cultural heritage techniques with modern materials to complete spatial design solutions. Meanwhile, a course titled “Aesthetic Marketing in Commercial Spaces” is jointly developed by schools and enterprises, in which students design experience stores for real businesses and undergo special evaluations by the enterprises on the “commercial transformation of aesthetics”, thereby enhancing their practical and innovative capabilities.

4.3. Three-dimensional immersion strategy integrating aesthetic education

Firstly, aesthetic education is integrated into professional courses to construct a “knowledge-aesthetic” symbiotic curriculum matrix. In the course “Architectural Decoration Materials and Construction”, a “Material Aesthetic Archive” is added for each type of material, analyzing the natural texture narratives of wood, the industrial aesthetic expressions of metal, and the textural presentations of stone. In the course “CAD Drawing”, emphasis is placed on the equal importance of “the aesthetic order of lines” and “drawing standardization.” Through exhibitions of excellent drawings and practical training in layout aesthetics, students’ aesthetic awareness of drawings is strengthened. Specialized breakthroughs are pursued through expanding courses, with an elective course titled “Design Ethics and Aesthetics” offered to explore issues such as the aesthetic alienation of excessive decoration, the emotional aesthetics of age-appropriate design, and the ecological aesthetics of sustainable design, guiding students to establish a “people-centered” design value system.

Secondly, aesthetic education is integrated into practical teaching to create a closed-loop practical training system of “project chain-capability chain.” On-campus practical training achieves an aesthetic experience transitioning from “virtual” to “embodied.” An “interactive practical training space” is constructed, with simulated scenarios such as living rooms, bedrooms, and commercial exhibition halls built at a 1:1 ratio. When students engage in soft furnishings coordination and lighting design, real-time feedback on color comfort levels and material tactile scores is provided through intelligent sensors, helping students predict the actual aesthetic effects of their design solutions. Off-campus practice constructs a project progression from “participation” to “leadership.” Practical projects follow a three-tier progression of “cognitive internships (visiting enterprise aesthetic exhibition halls) → on-the-job practice (assisting designers in collecting aesthetic materials) → On-the-job practical training (independently undertaking small-scale spatial aesthetic design)”, with enterprises recording students’ performance in cultural understanding, aesthetic decision-making, and solution expression in projects according to the “Aesthetic Competency Growth Manual.”

Furthermore, integrate aesthetic education into campus culture, create an immersive environment featuring “explicit symbols—implicit atmosphere”, and establish a “mobile aesthetics classroom.” Set up “material

tactile walls” in the corridors of teaching buildings, allowing students to touch stones, woods, and metals with different surface treatments; install “visual display boards for design thinking”, showcasing the aesthetic adjustment process of outstanding projects from conceptual sketches to final implementation. Organize a “Biennial Exhibition of Graduation Works”, inviting citizens and industry experts to participate in “public aesthetic voting” alongside professional evaluations, fostering a dialogue space between campus aesthetics and social aesthetics. Additionally, launch “Designer Afternoon Tea” events, inviting alumni and industry designers to share real-life experiences of “aesthetic compromises and persistence” in their projects; establish an “aesthetic reflection journal” system, requiring students to record aesthetic breakthroughs, cultural expression dilemmas, and improvement directions after each design assignment, cultivating their aesthetic metacognitive abilities.

5. Practical outcomes and reflections

5.1. Typical cases and empirical outcomes

With the high-quality development of vocational education in China, new opportunities have emerged for the construction of a talent cultivation system for architectural interior design majors ^[4]. Taking the Architectural Interior Design major at Chongqing Energy Vocational College as an example, after implementing the “dual-subject, three-stage, three-integration” model for three years, remarkable practical outcomes have been achieved. At the student development level, students have consistently excelled in competitions such as the “Environmental Art Design” event at the Chongqing Vocational Colleges Skills Competition and the “Future Designer—National College Digital Art and Design Competition.” Scores for “cultural narrative integrity” in students’ coursework and graduation projects at this college have increased by 25% compared to previous years, with 60% of participating projects incorporating intangible cultural heritage elements and regional elements; enterprises have reported that graduates demonstrate significantly superior “ability to translate client aesthetic needs” and “innovative application of cultural elements” compared to students trained under traditional models. At the school-enterprise collaboration level, “aesthetic education practice bases” have been jointly established with 12 design enterprises, leading to the co-development of talent cultivation plans and aesthetic evaluation systems, and forming a long-term mechanism of “shared projects—co-cultivated talent—shared outcomes.”

5.2. Research reflections

The existing challenges mainly focus on two aspects. Firstly, the boundaries of rights and responsibilities of the dual subjects still need to be clearly defined. Some enterprises have insufficient participation in curriculum development and the construction of evaluation systems, so it is necessary to clarify the division of labor through the “Memorandum on School-Enterprise Aesthetic Education Collaboration.” Secondly, there are significant differences in the aesthetic education foundations of students from different educational backgrounds (general high schools/secondary vocational schools). It is essential to establish a stratified training mechanism and add an intensive module on aesthetic foundations for students from secondary vocational schools.

6. Conclusion and prospect

The “dual-subject, three-stage, three-integration” aesthetic education immersion model constructed in this study has broken down the aesthetic barriers between education and industry through in-depth school-enterprise collaboration. It has achieved a spiral ascent of aesthetic education goals through stratified and progressive

training, and formed an ecological pattern of “professional education as aesthetic education” through full-scenario immersion. Practice has demonstrated that this model effectively addresses the issues of fragmentation, superficial collaboration, and inefficient immersion in aesthetic education for the architectural interior design major, significantly enhancing students’ aesthetic abilities, cultural literacy, and social responsibility.

Under the dual impacts of globalization and digitalization, the modern transformation of traditional culture has become a core proposition of national cultural strategy ^[5]. In the future, it is necessary to continuously deepen the connotation of aesthetic education through industry-education integration, strengthen the innovative integration of digital technology and traditional aesthetics, and constantly optimize the dual-subject collaboration mechanism and stratified training strategies. This model not only provides a replicable, practical path for aesthetic education in the architectural interior design major but also offers valuable insights for the reform of aesthetic education in art-related vocational education. It helps cultivate design talents in the new era who are “technically proficient, aesthetically outstanding, and culturally confident”, and promotes the continuous improvement of the aesthetic education ecosystem in vocational education.

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Research on the Talent Training Model of Tourism Management in Local Universities Based on the Integration of Production and Education

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Abstract: With the continuous development of China's social economy, the tourism industry has gradually entered a fast track of development. Against this background, society's demand for high-quality tourism management talents is also constantly rising. As an important training base for tourism management talents, university tourism management majors should also further promote the "integration of production and education" talent training model, strengthen the connection between professional teaching and social talent needs, cultivate more high-quality and comprehensive tourism management talents for society, and comprehensively promote the innovation and development of China's tourism industry. This paper discusses the practical value and practical paths of the talent training model of tourism management in local universities based on the integration of production and education, aiming to provide some references for teachers.

Keywords: Local universities; Tourism management major; Integration of production and education; Talent training

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1. Introduction

The "Several Opinions on Deepening the Integration of Production and Education" clearly points out that deepening the integration of production and education and promoting the effective connection between the education chain, talent chain, industrial chain, and innovation chain are urgent requirements for promoting the structural reform of the talent resource supply side. It is of great significance for comprehensively improving education quality, expanding employment and entrepreneurship, promoting economic transformation and upgrading, and cultivating new drivers of economic development under the new situation^[1]. Faced with the current background of increasing social demand for tourism management talents in both quantity and quality, university tourism management majors should also actively innovate the talent training model, break the boundary between industry and teaching, and build a collaborative talent training system based

on the integration of production and education, so as to comprehensively improve the quality and effect of talent training, help students better employment and development, and cultivate more high-quality tourism management talents for society ^[2].

2. Practical value of the talent training model of tourism management in local universities based on the integration of production and education

2.1. Assist students' growth and ensure their employment

The integration of production and education, as the name implies, refers to the in-depth integration of industrial practice and education and teaching. It can provide more opportunities for tourism management students to contact and understand job work, enabling them to exercise their abilities in real job work and improve their professional skills and comprehensive quality ^[3]. At the same time, under this model, students can also learn more new knowledge, new content, new standards, and new policies in the tourism industry, which helps them better plan their career development in the future and enhance their employment competitiveness. In addition, under this model, students can learn new knowledge and skills from real industrial job practice, which is also conducive to the cultivation of their good professional literacy, thus laying a foundation for their better employment and development in the future ^[4].

2.2. Promote educational reform and improve talent training quality

In the new era, society's demand for high-quality tourism management talents is constantly rising. Against this background, the talent training model of university tourism management majors is also in urgent need of innovation and reform. The promotion of the integration of production and education is conducive to the teaching reform and innovation of this major and the comprehensive improvement of talent training quality ^[5]. On the one hand, under this model, professional teachers no longer have to teach centered on textbooks and classrooms as before, but can carry out teaching based on the post practice of industries and enterprises. This can not only improve teachers' comprehensive quality, but also create a new teaching model of tourism management major based on social talent needs, and improve the connection and adaptability of talent training. On the other hand, under this model, the theoretical and practical links of tourism management students will be closer, which helps them integrate learning, thinking, and doing, thus comprehensively improving their comprehensive quality and leading the talent training quality of this major to a higher level.

2.3. Serve enterprise development and drive the local economy

With the continuous development of the tourism industry, the traditional talent training model of tourism management majors is also continuing to innovate and reform. The integration of the production and education model emphasizes in-depth cooperation between universities and enterprises. Its ultimate goal is to improve the talent training quality of institutions of higher learning while transporting more high-quality talents for society and enterprises, effectively solving the employment problem of enterprises and students ^[6]. Therefore, under this model, various links, such as the teaching objectives and teaching process of the tourism management major, should be fully integrated with elements such as enterprise talent needs and practical post-work. Against this background, the talent training quality of this major will surely be effectively improved, thus cultivating more high-quality and comprehensive tourism management talents for society.

3. Practical paths of talent training of tourism management in local universities based on the integration of production and education

3.1. Based on industrial practice, clarify talent training objectives

Objectives are the premise of action. Under the background of the integration of production and education, teachers should deeply grasp the characteristics of this model, clarify the teaching objectives of this major from the perspective of industrial needs, ensure the connection between the talent training of the tourism management major and enterprise talent needs, and thus cultivate more high-quality tourism management talents for society ^[7]. Firstly, it is necessary to go deep into tourism management enterprises to understand the real needs of current enterprises for tourism talents and the specific content of the relevant post work. On this basis, combine talent demand standards with education and teaching, and set the talent training goal on the cultivation of high-quality and comprehensive talents, laying a foundation for the effective development of subsequent education and teaching. Secondly, teachers should also pay attention to starting from the perspective of “student-centered”, and guide students to formulate their own learning goals and career goals based on their current employment plans and industry development trends, so as to promote their better learning and growth ^[8]. Furthermore, teachers can introduce the innovative talent training needs of current industrial demand into teaching from the perspective of the connotation characteristics and value significance of this model, improve the setting of teaching and talent training objectives, and thus provide an effective guarantee for the improvement of the talent training quality of this major ^[9].

3.2. Optimize the education system and ensure talent training effect

For the teaching of tourism management majors in universities, in the process of promoting the collaborative talent training of the integration of production and education, it is necessary to build a matching education system to comprehensively improve the quality of education and teaching, and talent training ^[10]. Firstly, it is necessary to optimize and innovate the curriculum teaching content, and actively introduce the new needs and new content of the current tourism management industry and enterprises into teaching to ensure the effective connection between education and teaching and the future post-work content of students, providing help for their subsequent employment and development. Secondly, in terms of practical teaching, this major should actively connect with tourism enterprises and industries to carry out talent training cooperation on “integration of production and education classes”, providing students with opportunities for practice and internship in enterprises, so as to break the boundary between the talent training chain and demand chain and effectively improve the quality and effect of talent training ^[11]. Furthermore, it is necessary to innovate the professional teaching model and build a new teaching system for the tourism management major, suitable for the integration of production and education. Specifically, project-based and task-based teaching models can be introduced into teaching to promote the in-depth integration of students’ theoretical learning and practical operation, enabling them to effectively help the cultivation of their professional abilities and comprehensive quality through “learning by doing” and “doing by learning” ^[12]. In addition, it is necessary to innovate and optimize the teaching evaluation system of this major, that is, on the basis of the previous teacher evaluation, actively introduce multiple subjects to bring more comprehensive ideas and inspiration to students, and promote their better learning and growth. For example, in the teaching process, guide students to comment and interact with each other to promote mutual learning and common progress; jointly invite personnel from the tourism management industry and enterprises to comment on students’ learning and practice, and put forward corresponding guiding suggestions from the perspective of professionals, so as to promote the improvement of students’ learning effect

and the development of comprehensive quality.

3.3. Improve teacher team construction and enhance talent training quality

Teachers are the foundation of education. As guides and assistants in educational activities, the level of teachers' own abilities and qualities directly affects students' learning and development. Faced with the current background of increasing social demand for tourism management talents in both quantity and quality, this major should also actively promote the construction and improvement of the teacher team, so as to lay a foundation for the improvement of the talent training quality of this major. Firstly, universities should do a good job in teacher training. For example, they can actively connect with relevant experts and professionals from tourism enterprises, then organize corresponding seminars and training sessions to bring more advanced concepts and knowledge to teachers, strengthen teachers' understanding of the tourism industry and enterprise talent needs, and change teachers' educational concepts ^[13]. On this basis, teachers can be organized to take on temporary posts or internships in enterprises to help them deeply understand the new trends and changes in the current development of the tourism industry and strengthen their cognition of specific post skills and talent needs. Secondly, professional teachers can be organized to set up teaching and research groups based on the integration of production and education, to jointly discuss and analyze practical problems in current education and teaching, and explore effective paths for promoting the integration of production and education model, so as to provide a guarantee for the improvement of talent training quality ^[14]. Furthermore, attention can be paid to introducing professional talents from enterprises as part-time teachers to supplement the school's teacher team, enabling them to form a good complementary relationship with the school's professional teachers, make up for the insufficient educational ability of professional teachers in practical operation and post work, bring more "front-line" knowledge and skills education to students, promote the improvement of the overall level and quality of the teacher team, and lay a foundation for the improvement of the talent training quality of this major.

3.4. Focus on resource integration and strengthen base construction

The high-quality development model of the integration of production and education should also pay attention to the construction of practical bases in the process of promotion. This also requires university tourism management majors to actively connect with enterprises, and on this basis, fully integrate the resources of both parties to build professional and modern practical bases, providing a platform for students' professional knowledge learning and skill practice, and promoting the cultivation and development of their comprehensive quality. Firstly, the tourism management major should actively connect with tourism enterprises and industries in society to jointly build tourism management practical bases based on the advantages of both parties in venues, funds, talents and other aspects, so as to provide a platform for the effective promotion of the integration of production and education model and the development of students' comprehensive quality ^[15]. For example, Hainan Vocational University of Science and Technology has actively promoted the construction of the integration of production and education bases, carried out cooperation with enterprises on bases, and given play to the advantages of the school's bases and teachers, and enterprises' funds and technology to build a comprehensive "college graduate employment and internship base." This base will provide complete venues, advanced equipment, diverse posts, and senior teachers. At the same time, the base is designed to simulate a real tourism management working environment, providing students with a learning and practical platform close to actual work, so as to promote the development of students' professional abilities and comprehensive quality. Secondly, universities should actively promote the "digital" and "intelligent" upgrading of base construction

based on the current development of the tourism management industry. For example, digital practical operating systems and digital analysis tools can be introduced to create scenarios in line with the current digital upgrading and development of the tourism industry, bringing more development opportunities for students and promoting their growth and development. Furthermore, universities and enterprises should establish a collaborative management mechanism based on base management to ensure the effective operation of the base. For example, the school can assign professional teachers of tourism management, and enterprises can select senior industry practitioners to jointly serve as base managers and practical training instructors, providing students with “theory + practice” two-dimensional guidance. On this basis, combined with relevant projects and internship assessment and evaluation systems, process evaluation can be implemented in a base practical training to promote the effective development of practical talent training work and lead to the effective improvement of the talent training quality of this major.

4. Conclusion

In summary, in the new era, actively promoting the integration of the production and education model has become an important direction for the teaching reform of university tourism management majors. In this regard, universities and teachers should also deeply recognize the connotation, significance and value of this model, and on this basis, continuously use scientific and effective paths and methods to create a new teaching model of tourism management major based on the integration of production and education, so as to strengthen the connection between the teaching of this major and talent training, and deeply integrate talent training with the current talent needs of the tourism industry, so as to promote students’ employment and development, and at the same time transport more high-quality and comprehensive tourism management talents for society, truly realizing the goal of promoting win-win results for all parties through the integration of production and education.

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Research on the Paths of Promoting the Spirit of Educators from the Perspective of Building a Powerful Education Nation

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Abstract: With the deepening of educational reform, teachers should analyze the spirit of educators when carrying out education work, so as to lay a solid foundation for the subsequent development of education work. In view of this, this paper will analyze from the perspective of building a powerful education nation, combining the research significance and existing problems of the spirit of educators, and put forward some strategies for reference.

Keywords: Powerful education nation; Spirit of educators; Paths; Research

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1. Significance of promoting the spirit of educators from the perspective of building a powerful education nation

1.1. Conducive to improving teachers' professional realm

The spirit of educators can help teachers better break through their professional limitations and examine educational work from a higher perspective. Only when teachers adhere to the ideals and beliefs of having a broad mind and serving the country with sincere dedication can they deeply recognize the close connection between the cause of education and China's development. In fact, education is the cornerstone of national development. By cultivating more high-quality talents, teachers can invisibly inject new vitality into various fields such as the national economy and culture, thereby effectively promoting national progress^[1]. With this cognition, people should regard their daily teaching work as an important link in realizing national strategic goals. Every teaching and communication in the classroom may affect students' future development and thus have an impact on the country's future. This will also greatly enhance teachers' sense of professional mission and responsibility, making them no longer regard the teaching profession merely as a job but pursue it as a great cause. For example, when facing the problem of unbalanced educational resources, teachers with the spirit of

educators may take the initiative to engage in educational poverty alleviation work, bring knowledge and hope to children in remote areas, practice the concept of educational equity with their practical actions, cultivate more outstanding talents for the country, and help national development.

1.2. Assisting teachers' professional growth

The educational wisdom in the spirit of educators comprehensively promotes teachers' professional growth. The educational wisdom of teaching students in accordance with their aptitude requires teachers to deeply understand the characteristics and needs of each student, which also invisibly encourages teachers to continuously learn relevant knowledge, such as psychology and education, thereby greatly improving their ability to recognize and guide students ^[2]. In teaching practice, educators should design personalized teaching plans according to students' different situations, and actively adopt more diverse teaching methods to stimulate students' learning interest and potential. This will effectively exercise teachers' teaching design and classroom organization abilities. The attitude of seeking truth and innovation can inspire teachers to continuously pursue the renewal of knowledge and the innovation of teaching methods. Therefore, educators should keep up with the times, actively pay attention to the cutting-edge trends of the discipline, so as to continuously enrich their professional knowledge. In addition, educators need to actively explore new teaching models, such as trying to use information-based teaching means to improve teaching efficiency and quality, and introducing new teaching models such as flipped classrooms and project-based learning. All these require them to have the spirit of courage to innovate and the ability to continuously learn. In this process, teachers' professional quality has been greatly improved.

1.3. Shaping a good image of teachers

Every word and deed of teachers will have a profound impact on students' future development. In fact, students are in a critical period of forming values and behavioral habits, and they will unconsciously imitate teachers' words and deeds. A teacher with noble morality will convey positive values through words, and inspire students' self-confidence and enterprising spirit with encouraging and guiding words. In terms of behavior, teachers with the spirit of educators will set an example, abide by social morality and professional ethics, and show excellent qualities such as honesty, dedication, and care for others ^[3]. For example, teachers with the spirit of educators can be more rigorous in academic research in the classroom, treat students equally, and respect the personality and dignity of each student. These behaviors will plant the seeds of morality in students' hearts, allowing students to be infected and educated imperceptibly, thereby guiding students to establish correct values and behavioral norms. Teachers become models of morality and behavior for students, which is not only conducive to students' growth but also enhances teachers' image and reputation in society, and promotes the whole society's respect and support for the cause of education.

2. Problems in promoting the spirit of educators from the perspective of building a powerful education nation

2.1. Outdated educational concepts

At this stage, traditional educational concepts have a great invisible impact on the teacher group. Some teachers pay too much attention to knowledge transmission, focusing on explaining knowledge points and students' memory of knowledge, while ignoring the cultivation of students' comprehensive abilities ^[4]. In classroom

teaching, some teachers adopt the cramming teaching method, usually with teachers dominating the classroom teaching and students passively accepting knowledge. This will lead to students' lack of opportunities for independent thinking and exploration, thus affecting the development of students' innovative thinking and practical abilities, and students will find it difficult to adapt to the new era's demand for innovative talents. In the new era, society's requirements for talents have become more diversified. In addition to solid professional knowledge, students also need comprehensive qualities such as good communication skills and teamwork abilities. In addition, some teachers have a narrow understanding of educational equity. In teaching, they fail to fully pay attention to the individual differences and developmental needs of each student, making it difficult to teach students in accordance with their aptitude. This will also result in some students with weak learning abilities or special needs not receiving the due attention and help, which greatly affects their learning enthusiasm and development potential.

2.2. Insufficient own abilities

In fact, educational wisdom is an important embodiment of the spirit of educators, but many teachers do not have the corresponding qualities and abilities. When facing students' problems and confusion, many teachers cannot deeply understand students' inner world, nor can they use appropriate ways to guide and inspire students. When dealing with conflicts between students, some teachers lack effective communication skills and educational methods, which will lead to the failure of timely resolution of conflicts between students, thus invisibly affecting the harmonious relationship between students ^[5]. In classroom teaching, some teachers find it difficult to adjust teaching strategies according to students' real-time reactions, which has a great impact on teaching effects. In curriculum design, some teachers' teaching work lacks innovation. They find it difficult to design creative teaching activities combined with subject characteristics and students' interests, which will lead to a relatively boring classroom teaching process and make it difficult to stimulate students' learning interest.

2.3. Restrictions from the external environment

At this stage, the educational evaluation system has largely restricted teachers' promotion of the spirit of educators. In many schools, the evaluation of teachers mainly focuses on students' exam scores and admission rates. This will lead teachers to invest a lot of energy and time in improving students' scores, thus ignoring the cultivation of students' comprehensive qualities and the innovation of their own educational concepts and methods. In addition, in order to pursue higher scores, some teachers may adopt exam-oriented teaching methods to compress students' independent learning and practice time, which violates the concepts of comprehensive education and teaching students in accordance with their aptitude in the spirit of educators ^[6]. Moreover, the uneven distribution of educational resources is also a prominent problem. In some remote areas and rural schools, the overall teaching facilities are relatively simple, and there is a lack of necessary experimental equipment, books, and materials in teaching work, which will also invisibly limit the development of teachers' teaching activities. Teachers in these areas also often lack opportunities for professional training and further study, making it difficult for them to come into contact with advanced educational concepts and teaching methods. This will hinder their professional growth and affect their practice of the spirit of educators. In addition, the excessive expectations and attention of society on education will invisibly bring great pressure to teachers. Parents and society often attribute students' development entirely to teachers. If students have problems, teachers will be accused and questioned. This leads teachers to be timid in teaching and dare not

make bold innovations and practices, which is not conducive to the promotion of the spirit of educators.

3. Paths of promoting the spirit of educators from the perspective of building a powerful education nation

3.1. Updating educational concepts

To further improve the effect of promoting the spirit of educators from the perspective of building a powerful education nation, educators should attach importance to the innovation of educational concepts. Teachers should actively learn advanced educational concepts and take the initiative to participate in professional training, academic seminars, etc., so that teachers can continuously come into contact with and absorb more new educational ideas and methods. For example, educators can try to regularly participate in online training courses on educational concepts to learn educational experts' interpretations of the latest educational policies and concepts. In addition, educators can actively participate in offline academic seminars to communicate with other teachers about the understanding and application of educational concepts in teaching practice. In the learning process, educators should deeply understand the connotation of the student-centered educational view, take the initiative to recognize that students are individuals with independent personalities and unique needs, and fully respect their dominant position in teaching^[7]. In classroom teaching design, educators should ensure that teaching work starts from students' interests and needs, design more inspiring and interactive teaching activities, actively encourage students to participate in classroom discussions, and stimulate students' learning initiative and creativity.

In teaching, in addition to focusing on the transmission of subject knowledge, educators should also take the initiative to cultivate students' comprehensive qualities, such as learning ability and innovation ability. For example, in Chinese teaching, in addition to teaching students knowledge such as words and poems, educators can also cultivate students' reading comprehension ability and thinking expression ability through organizing activities such as literary work appreciation and writing practice. In addition, the cultivation of innovation ability is also an important goal of education in the new era. Educators should encourage students to dare to question and explore, and continuously develop students' innovative thinking and practical ability. In science course teaching, educators can try to guide students to conduct more experimental explorations, encourage them to put forward their own hypotheses and experimental plans, so that students can verify and improve in practice, and promote the further development of their innovative spirit and practical ability.

3.2. Improving own qualities

To ensure the effect of promoting the spirit of educators from the perspective of building a powerful education nation, educators should take the initiative to participate in various professional training, such as subject knowledge training and educational information technology training, so as to continuously update and expand the knowledge and skill system. For example, by participating in training on cutting-edge subject knowledge, educators can invisibly learn more of the latest research results and development trends in the subject field, and then integrate them into teaching, making the teaching content more contemporary and cutting-edge. By participating in educational information technology training, educators can gradually master some multimedia teaching tools and online teaching platforms, so as to improve the informationization level of teaching^[8]. Educational research is an important way for teachers to improve their professional quality. Therefore, educators should actively carry out research related to education and teaching, take the initiative to explore the laws of

education and teaching, actively solve various problems in teaching practice, and determine research topics combined with their own teaching practice. In addition, educators can also conduct a more in-depth analysis of problems through methods such as literature review, put forward better solutions, and verify and improve them in teaching practice. By continuously summarizing experience, educators can gradually form a set of their own educational and teaching theories and methods.

Teaching reflection is an important means for teachers' self-growth. Therefore, educators should take the initiative to develop the habit of teaching reflection and regularly reflect on and summarize their own teaching practice. After each class, educators can try to review the teaching process, think about whether the teaching goals have been achieved and how students' learning reactions are, then analyze the advantages and disadvantages in teaching, and put forward improvement measures. Moreover, teachers can conduct a comprehensive teaching reflection every week or month, summarize the teaching experience and lessons of the week or month, so as to formulate a more reasonable and scientific teaching improvement plan for the next stage. Through continuous reflection and summary, teachers can continuously adjust their teaching behaviors and improve their teaching level. In addition, teachers also need to continuously improve their moral cultivation, so as to set a better moral example for students. In communicating with students, educators should respect students' personality and dignity, care about students' physical and mental health, learn to transmit positive energy with their own words and deeds, and take the initiative to guide students to establish correct values and moral views.

3.3. Improving the external environment

In the activity of promoting the spirit of educators from the perspective of building a powerful education nation, the improvement of the educational evaluation system is an extremely important part. Therefore, educational departments and schools should try to establish a more diversified educational evaluation system, and take the initiative to change the previous teacher evaluation method that solely focuses on students' exam scores and admission rates. The new teacher evaluation indicators should include multiple aspects such as teaching process, teaching innovation, and quality improvement, focusing on a more comprehensive evaluation of teachers' educational and teaching work. By adding evaluation indicators for teachers' teaching innovation, teachers can be encouraged to explore new teaching models and methods more actively and proactively. In addition, educators need to pay attention to teachers' guidance and support for students' personalized development, and evaluate whether teachers can teach students in accordance with their aptitude, so as to better meet the learning needs of different students^[9]. In daily teaching, schools should attach importance to teachers' achievements in educational and teaching research, encourage teachers to carry out educational scientific research, which can also effectively improve teachers' educational and teaching level. Through more diversified evaluation, teachers can be guided to better pay attention to students' all-round development, which is conducive to helping teachers practice the spirit of educators.

In addition, the government should increase investment in educational resources, especially support for some remote areas and rural schools. Improving the teaching facilities and conditions in these areas can greatly help teachers' teaching work. Therefore, educators should increase capital investment in rural schools, build more modern teaching buildings and laboratories, and equip teachers with more advanced teaching equipment, which can provide good hardware support for teachers' teaching activities. At the same time, educators should further strengthen the balanced distribution of educational resources, narrow the gap in educational resources

between urban and rural areas, so that every teacher can carry out teaching work in a relatively fair environment, which can also create favorable conditions for promoting the spirit of educators ^[10]. In addition, educators should strengthen the balanced distribution of teacher training resources, provide equal training opportunities for teachers in different regions, so that they can all come into contact with advanced educational concepts and teaching methods, and improve their own qualities. By publicizing the importance of education and the contributions of teachers, educators can increase society's attention and recognition of the cause of education, and make teachers feel the value and significance of their work. Parents should establish a good communication and cooperative relationship with teachers, actively cooperate with teachers' teaching work, and jointly pay attention to students' growth and development. When students have problems, parents and teachers should consult and solve them together instead of attributing all the responsibility to teachers.

Disclosure statement

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Research on the Construction of an Intelligent Teaching Interactive Platform for Universities Based on the Internet of Things, Cloud Technology, and Big Data

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Abstract: Through research and analysis of the current situation of teaching models in universities, this article summarizes the problems of limited teaching methods, rigid teaching activities, and scattered teaching resources. It proposes the idea and application strategy of using information technology to deeply integrate education and teaching, and build an intelligent teaching interactive platform in universities, promoting the reform of intelligent teaching models and helping college students develop independent learning and personalized abilities.

Keywords: Higher education institutions; Teaching interactive platform

Online publication: December 3, 2025

1. Introduction

The 21st century is the century of “classroom revolution”, where artificial intelligence has disrupted this balance and accelerated the process of classroom innovation. In July 2017, the State Council issued the “Development Plan for the New Generation of Artificial Intelligence”, emphasizing the use of intelligent technology to accelerate the reform of talent training models and teaching methods, and to build a new education system that includes intelligent learning and interactive learning. In the era of informatization, the new talents needed by the country should have the awareness of actively constructing knowledge, deepen their self-learning ability through the interaction of existing knowledge and new knowledge, continuously enrich their own knowledge, and form a thinking mode suitable for the era of informatization. This article focuses on the research of information technology and intelligent teaching mode in universities, explores the deep integration of information technology and education teaching, explores the construction and innovation of intelligent teaching interaction platforms in universities, and helps college students to learn independently

and develop personalized abilities.

2. Analysis of the current status of teaching models in higher education institutions

2.1. The teaching methods are limited to standardization and fail to stimulate students' learning interest

The teacher's systematic explanation of knowledge architecture, core concepts, and theoretical systems to help students establish basic cognition remains the most common teaching form in universities. During the teaching process, teachers mostly organize interactions through classroom discussions, questioning and answering questions, presentations, and reports. Due to limitations in classroom time, space, and teacher resources, there are few opportunities for participation and communication, difficulties in sustainable development of interactions, an inability to record communication processes, and insufficient preparation for interactive thinking, which limits the effectiveness of traditional interactive teaching methods ^[1, 5].

2.2. Teaching activities are hindered by stereotypes and cannot meet the needs of work practice

In the process of teaching activities, teachers mainly impart knowledge to students and fail to provide personalized teaching plans by analyzing students' learning behaviors and habits. Classroom exploration activities are difficult to arrange, and the integration of "teaching" and "practice" in professional courses is insufficient. Students only focus on learning knowledge, and there is insufficient cultivation of higher-order thinking, such as innovation ability, problem-solving ability, decision-making ability, and critical thinking. There is also less emphasis on practical application, independent thinking, and proactive thinking, resulting in poor effectiveness of existing teaching activities in cultivating applied and forward-looking talents.

2.3. Teaching resources tend to be fragmented and cannot meet the needs of shared applications

In the teaching process, information resources are relatively abundant, but overall, they are quite complex. Due to different sources, diverse types, and independent system segmentation, it is difficult to share and use them. Teaching resources mainly rely on personal collections by teachers, which are limited by factors such as teaching experience and collection methods, resulting in uneven quality of resources and a lack of targeted collection and organization of teaching resources ^[2]. At the same time, most of the information resources used by teachers have not been collected uniformly and have not been standardized. Unstructured data, such as videos, images, and documents, lacks means and platforms for sharing and use, resulting in low utilization of information resources and poor teaching effectiveness.

3. Research on the advantages of intelligent teaching modes in universities

3.1. Intelligent teaching mode

With the continuous deepening of teaching reform, the integration of information technologies such as the Internet of Things, cloud technology, and big data with courses has become a key and hot topic in teaching research ^[3]. The integration of information technology and curriculum refers to a new teaching and research method that organically integrates information technology, information resources, information methods,

human resources, and curriculum content in the process of curriculum teaching, and jointly completes classroom teaching tasks. The intelligent teaching model inherits the concepts of “Rate of Response” and “Cumulative Response Recording” from behaviorism theory, by recording students’ behaviors and guiding them in learning based on the obtained data. The essence of an intelligent teaching mode is to use information technology with computers and networks as the core, guided by advanced educational ideas and theories, as cognitive tools, emotional incentive tools, and creation tools to promote students’ autonomous learning, and to enrich the teaching environment. These tools are fully applied to the teaching process, so that teaching resources, teaching elements, and teaching links can be combined, reconstructed, and integrated on the basis of overall optimization to produce a clustering effect, thereby achieving the goal of promoting the transformation of traditional teaching methods, cultivating students’ innovative spirit, and practical ability. The specific mode is shown in **Figure 1**.

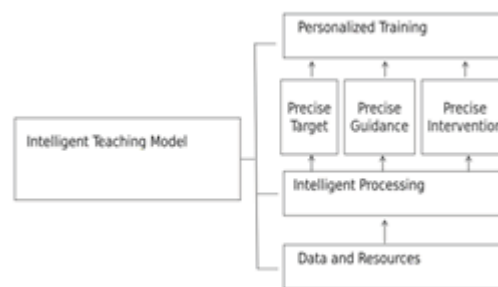


Figure 1. Schematic diagram of the intelligent teaching mode

The intelligent teaching model has three core points ^[4]. Firstly, data and resources serve as the foundation for implementing intelligent teaching. Various learning process behavior data generated based on teaching platforms, teaching spaces, etc. are aggregated into an educational big dataset, which, together with processed teaching plans, documents, videos, images, and other retrievable and guided educational resource pools, provides a basis and support for intelligent teaching; The second is the use of intelligent processing methods as a method path for implementing intelligent teaching. By analyzing teaching data through big data, classification features are extracted to form a dynamic personal profile that reflects students’ learning situation. This is compared and analyzed with the training target model to assist in planning the training path and training methods. At the same time, teaching resources are uniformly identified and processed to form structured resources that can be called by the system, opening up a tunnel of effective correlation between teaching resources and the system, and providing tools and materials for intelligent teaching. The third is that personalized training is the goal concept of intelligent teaching. Based on the theory of humanism, the concepts of “people-oriented” and “teaching according to aptitude” are integrated into the teaching process. Through the introduction of big data and intelligent technology, it promotes the transformation of information education in universities to achieve the ideal state of personalized teaching. Through guidance and intervention, it promotes the “supply side” of talents in universities to fit the “demand side” of national strategic positions.

3.2. The advantages of intelligent teaching

The key to an intelligent teaching mode lies in exploring how to fully tap into students’ initiative, enthusiasm,

and creativity from the perspective of creating an ideal teaching environment through modern teaching media. It has the following advantages.

3.2.1. Rich information sources are conducive to creating learning contexts

The intelligent teaching technology provides a teaching environment for classroom teaching, making the sources of information in teaching more abundant. Teachers and textbooks are no longer the only sources of information. The use of multiple media can not only expand the content of knowledge and information, but also fully mobilize students' multiple senses, providing students with a better learning environment.

3.2.2. Individualized teaching is conducive to teaching students according to their aptitude

The interactivity of information systems provides students with the possibility of personalized learning. Through intelligent teaching technology, students can fully present the content and process of learning, independently choose the difficulty and progress of learning content, and interact and discuss with teachers and learners at any time. In the information-based learning environment created by intelligent educational technology, students are gradually breaking away from the traditional teacher-centered model and shifting from passive learning to active learning, which is conducive to individualized teaching.

3.2.3. Mutual assistance and interaction are conducive to achieving collaborative learning

The interactive features of information systems and the universal characteristics of networks are conducive to cultivating students' spirit of cooperation and promoting collaborative learning for the development of advanced cognitive abilities. In the information-based learning environment, students participate in learning through various interactive forms such as collaboration, competition, or role-playing, which is of great significance for deepening understanding of problems and mastering and applying knowledge. It also has a significant promoting effect on the development of advanced cognitive abilities, the cultivation of cooperative spirit, and the formation of good interpersonal relationships ^[6].

4. Construction ideas for intelligent teaching interactive platforms in universities

The Regulations on Higher Education stipulate that universities should establish intelligent teaching, management, and service platforms, strengthen the construction of smart campuses and classrooms, develop information resources, and provide services for educational work in colleges and universities. To ensure the smooth implementation of teaching practices in universities and provide a high-quality learning environment for the cultivation of new talents, it is necessary to first build a smart teaching service platform that integrates "teaching, learning, management, and evaluation", and use information technology to quickly and efficiently transmit knowledge to students.

4.1. Building an online lesson preparation system to reform teaching methods through informatization

Focusing on the intelligent teaching concept of precision teaching and personalized teaching, educators aim to build an online lesson preparation system with the goal of "Golden Course" construction. Based on new models, methods, and concepts such as heterogeneous and asynchronous lesson preparation, educators rely on advanced technologies such as big data and cloud storage to comprehensively consider the needs of pre-

class learning situation statistical analysis, automatic matching and push of teaching resources, teaching design, lesson plan writing, and archiving. The system aims to serve teaching reform and innovation, and assist teaching management, providing support for teachers to comprehensively grasp student situations, coordinate lesson preparation with multiple people, share and optimize teaching resources, facilitate course preparation, and match classroom teaching activities with lesson preparation content. Based on the integration of individual and collective lesson preparation through the internet, the online lesson preparation system is designed according to the process of learning situation analysis, activity design, activity sequence design, teaching resource allocation, and electronic lesson plan review and release.

4.2. Building an online learning system to promote collaboration and communication through informatization

Build an online learning system that integrates resources, services, and data, supports sharing, interaction, and innovation, and achieves a “universal” online learning system. Space integrated teaching application, teaching content, teaching tools, personalized learning platform that can be used for teaching communication, customized, and editable, with core attributes such as digital resource and intellectual resource sharing, diverse interaction between people and machines, collaborative creation, and innovative creation. It has basic characteristics such as individualization, openness, connectivity, and adaptability. As a unified online learning system service for teachers, students, and administrators, the online learning system focuses on strengthening the spatial functions of administrators, members, applications, generative resource management functions, public application services, and data analysis services of institutional spaces. During the interactive teaching process, students continuously build knowledge, enhance skills, stimulate thinking, showcase individuality, and broaden their horizons. Based on the analysis of classroom interaction data, it empowers teachers to teach more accurately and according to their aptitude, and helps them form a scientific and systematic spiral development model.

4.3. Building a teaching resource system to support resource sharing through informatization

Build a teaching resource system to provide high-quality educational resources for teaching. Through service integration, gather digital resources from colleges and universities, access them according to unified technical standards, and record them according to unified metadata standards. Support the hierarchical distribution of resources according to unified user standards, resource standards, service standards, and management standards. Further improve the resource aggregation and sharing methods of independent aggregation, co governance, and sharing among platforms at all levels within the system, innovate the environment for resource supply and sharing mechanisms, break the “information island”, expand resource coverage, push them to online lesson preparation systems and smart teaching systems according to the needs of each teaching system, achieve resource aggregation and sharing, and realize “one point access, full system sharing” of digital teaching resources.

5. Conclusion: Innovation in the application of intelligent teaching interactive platforms in universities

Universities are currently in a high-speed development stage of information and intelligent teaching

conditions construction, creating favorable conditions for the realization of intelligent teaching. To optimize and promote the implementation of intelligent teaching in universities, based on the research results of teaching practice experience in universities, a practical operation process for using an intelligent teaching interactive platform to achieve an intelligent teaching mode is proposed.

5.1. Pre-class: Teaching preparation, diagnosing the learning situation

Teachers obtain teaching resources, edit course plans and courseware, analyze student learning situations, optimize teaching plans, intelligently distribute and push pre-class learning resources, and publish preview tasks through the online course preparation system. Students use online learning systems to preview before class based on resources and tasks pushed by teachers, gain a preliminary understanding of course knowledge, interact and communicate with other students, and ask questions. Pre-class preparation enables teachers to grasp students' learning status, accurately grasp the key and difficult points of teaching, determine teaching objectives, select content, organize activities, intervene, and evaluate after students complete the preview.

5.2. In Class: Efficient interaction, diverse evaluation

Teachers create teaching scenarios according to the teaching plan and use interactive teaching systems to carry out multi-dimensional communication in flipped classrooms, remote collaboration, and intelligent classrooms. Record the classroom teaching process, intelligently edit and generate online courses, and dynamically improve the teaching resource library. Teachers post questions on the platform, and students participate in online discussions or group explorations to showcase their results. During the discussion and exploration, teachers provide real-time feedback to obtain formative assessment criteria. By using synchronous dependency behavior analysis technology, feedback data is generated from the teaching process to form a comprehensive classroom evaluation report, providing a basis for teaching reflection.

5.3. After class: Learn analysis and precise push notifications

Based on the analysis report of students' learning situation, teachers provide personalized exercises to help them identify and fill knowledge gaps. According to the training objectives, teachers track and guide students' learning to achieve personalized teaching. Students obtain resources through online learning systems, review after class, and learn independently through personalized recommendations. They build learning teams, organize joint research projects, and exercise higher-order thinking. At the same time, the platform automatically records students' learning, homework, communication, and training situations, combined with classroom performance and answer situations, comprehensively analyzes teaching effectiveness, evaluates weak links, and forms learning effectiveness analysis data, providing a scientific basis for teaching reform and classroom quality improvement.

6. Summary and outlook

Teaching in an information-based environment is not only an inheritance of traditional teaching, but also an exploration and construction of new teaching models in a technological environment. This article explores the construction of an intelligent teaching interactive platform based on the needs of intelligent teaching and training conditions in universities. Through system construction, it establishes a personalized learning

space for students to achieve unique talent literacy, helps managers and teachers accurately judge students' learning behavior, provides personalized learning resources, and assists universities in carrying out forward-looking talent cultivation teaching reforms. It provides data support for formulating teaching tasks, algorithm support for teaching intelligent applications, and condition support for the construction of key disciplines in universities such as “technology+”.

Disclosure statement

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Reforming Artificial Intelligence Curriculum in FinTech Major through OBE Pedagogical Philosophy

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Abstract: In the context of rapid financial technology development, this paper explores the reform of the “Principles and Applications of Artificial Intelligence” course for financial technology majors under the Outcome-Based Education (OBE) philosophy. Focusing on addressing the disconnect between theoretical knowledge and practical skills, as well as the need for interdisciplinary competence, the study first analyzes the current curriculum challenges, such as outdated content and limited real-world engagement. It then proposes a systematic reform framework that aligns learning outcomes with industry demands, restructures the curriculum to enhance the integration of finance and AI technology, introduces problem-based and project-driven teaching methods, and establishes a multi-dimensional assessment system. By integrating OBE principles, the reform aims to cultivate students’ abilities in AI application, data analysis, and innovative problem-solving, ensuring graduates meet the evolving needs of the fintech industry. The research provides a practical model for curriculum innovation in interdisciplinary fields, emphasizing student-centered design and continuous improvement.

Keywords: OBE teaching concept; Artificial intelligence course; FinTech; Curriculum reform; Practical ability; Higher education

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1. Introduction

The convergence of artificial intelligence (AI) and finance has reshaped the fintech landscape, driving a critical need for professionals who can integrate AI technologies into financial services. The “Principles and Applications of Artificial Intelligence” course, a core compulsory module for financial technology majors, plays a pivotal role in fostering such expertise. However, traditional teaching approaches often suffer from fragmented knowledge delivery, inadequate practical training, and a lack of alignment with industry outcomes, leading to graduates’ skills mismatching market requirements. The Outcome-Based Education

(OBE) philosophy, which emphasizes defining clear learning outcomes, designing curricula to achieve these outcomes, and using evidence-based assessment to measure student performance, offers a promising solution. This paper introduces an OBE-driven reform for the course, aiming to bridge the gap between academic instruction and professional competence. By redefining course objectives, restructuring content, and innovating teaching methods, the reform seeks to enhance students' ability to apply AI techniques to financial scenarios, analyze complex problems, and contribute to technological innovation in finance.

2. OBE philosophy and course objective redefinition

2.1. Core tenets of OBE in fintech education

Outcome-Based Education (OBE), grounded in a focus on what students are ultimately able to achieve, has become increasingly important for fintech programs as the field continues to evolve at a rapid pace. Its core ideas, which refer to clear learning targets, purposeful learning activities, and output assessment through verifiable evidence, fit well with the interdisciplinary demands of fintech ^[1-2]. In practice, this approach helps ensure that course objectives correspond closely to the skills required in real industry roles, such as financial data analysts or professionals working with AI-based risk assessment ^[1-2]. Under this framework, the course outlines three interconnected learning outcomes. The first involves developing solid competence in AI techniques commonly used in financial scenarios, such as machine learning models for credit evaluation, along with fluency in tools like Python and TensorFlow. The second emphasizes the ability to combine knowledge from finance and computer science to apply AI models in areas such as algorithmic trading or fraud detection. The third focuses on cultivating strong analytical and problem-solving abilities, enabling students to handle complex financial questions with careful judgment and critical thinking.

2.2. Alignment with programmatic and industry standards

Redefined course objectives are systematically mapped to the fintech program outcomes of the university, ensuring an integrated balance among financial theory, technological innovation, and professional ethics. This alignment process emphasizes not only disciplinary coherence but also the cultivation of interdisciplinary competencies that fintech positions increasingly demand. In particular, the course outcomes are benchmarked against industry standards and competency frameworks issued by authoritative bodies such as the Financial Stability Board, the Basel Committee on Banking Supervision, and leading fintech industry associations ^[3]. These benchmarks help ensure that students acquire relevant, up-to-date skills in algorithmic decision-making, data governance, and risk-aware AI deployment. A central component of this alignment involves strengthening the ethical dimension of AI applications in financial contexts. The course redesign explicitly integrates learning outcomes related to responsible and compliant use of AI, drawing on emerging regulatory frameworks such as the EU's AI Act and global guidelines on model transparency, fairness, and accountability ^[4]. By incorporating these standards into both theoretical instruction and applied case studies, the course aims to equip students with the ability to critically evaluate issues such as bias detection, explainability, and auditability of machine learning models used in financial services. This ensures that graduates are not only technically proficient but also capable of navigating complex regulatory environments and upholding ethical principles in real-world fintech scenarios.

3. Current status and challenges of the AI course

3.1. Analysis of existing curriculum design

Traditional AI curricula in fintech often fail to bridge theory and practice, leaving graduates underprepared for industry demands. Courses typically present AI concepts in isolation from financial applications, with few integrated case studies to demonstrate how algorithms support tasks such as credit risk assessment, algorithmic trading, or sentiment-driven market analysis ^[5]. Practical training remains limited and largely procedural, focusing on reproducing algorithms on sanitized datasets rather than navigating the complexity, multi-source nature, and regulatory constraints of real financial data. Assessment practices reinforce this gap, emphasizing theoretical recall through final examinations while offering little evaluation of problem-solving, collaboration, or project-based competencies. As a result, graduates may grasp AI concepts but lack the applied skills, interpretive insight, and ethical awareness necessary to deploy AI effectively in financial settings.

3.2. Gap between student learning and industry expectations

Fintech employer surveys highlight a persistent gap between graduate capabilities and industry expectations. Graduates generally possess a solid grasp of foundational AI concepts, yet they often struggle to apply these techniques in financial contexts, such as customizing natural language processing for market sentiment analysis or employing deep learning for portfolio optimization and risk management. Equally important is the ability to translate analytical results into actionable insights for non-technical stakeholders ^[6]. Many graduates find it challenging to communicate complex findings clearly, limiting their practical impact in decision-making processes. Ethical and regulatory competence remains another critical shortfall. Graduates are frequently underprepared to address algorithmic bias, ensure transparency in automated systems, or comply with data protection requirements such as those mandated by GDPR. These gaps collectively indicate that current curricula are insufficiently integrated with practical application, communication skills, and ethical awareness, leaving graduates less prepared to meet the multifaceted demands of the fintech industry.

4. OBE-driven curriculum and pedagogical reform

4.1. Outcome-oriented content restructuring

The revised curriculum is structured around three interrelated modules that closely align with Outcome-Based Education principles, ensuring both conceptual depth and practical applicability. One module focuses on foundational AI techniques within financial contexts, introducing machine learning, neural networks, and natural language processing through applications such as logistic regression for predicting loan defaults, reinforced with real-world case studies including Ant Group's microcredit scoring system. Building on this foundation, another module emphasizes advanced applications and technical proficiency, guiding students through hands-on projects such as robo-advisors and fraud detection systems, while providing training on industry-standard platforms like AWS SageMaker and Tableau. A complementary module addresses ethical and regulatory considerations, exploring algorithmic fairness, GDPR compliance, and RegTech innovations to prepare graduates for contemporary financial regulatory environments. By integrating theoretical instruction with applied practice across all modules, the curriculum overcomes traditional content silos, fostering a cohesive and practice-oriented learning experience that equips students with both technical expertise and regulatory awareness.

4.2. Innovative teaching methods for active learning

Active learning replaces traditional lectures with immersive, practice-oriented strategies. Problem-Based Learning engages students with weekly challenges—such as optimizing bank customer churn models—applying AI to real datasets. Flipped classrooms shift foundational content to pre-recorded lectures, freeing class time for coding exercises, collaborative discussions, and peer troubleshooting. Industry partnerships, including a 2024 project with a local robo-advisory firm, provide access to proprietary datasets and professional mentorship, reinforcing the connection between learning and real-world fintech practice. These methods collectively enhance engagement, practical competence, and professional readiness.

4.3. Multi-dimensional assessment system

The assessment approach emphasizes continuous, formative evaluation rather than relying on traditional summative exams. Student progress is monitored through process-oriented measures, including weekly coding assignments, project milestones, and peer feedback, which collectively track skill development over time. Capstone projects are evaluated using rubrics aligned with OBE principles, assessing technical accuracy, financial relevance, and adherence to ethical standards. Reflective journals and group presentations encourage self- and peer-assessment, promoting metacognitive awareness and collaborative learning. This framework provides ongoing feedback, guiding students steadily toward the targeted learning outcomes.

5. Implementation and preliminary outcomes

5.1. Pilot implementation and feedback

The reform was piloted in the 2024–2025 academic year with a cohort of 50 fintech students. Feedback from course evaluations indicated:

5.1.1. Enhanced engagement

Student engagement in laboratory sessions and Problem-Based Learning activities showed a notable increase of 37%, reflecting the motivating effect of connecting academic tasks to real-world financial applications. Students displayed a markedly more proactive and self-directed approach to learning, actively seeking to understand the practical implications of AI techniques in finance. For example, during a PBL session centered on optimizing a bank's customer churn prediction model, learners engaged in in-depth discussions, evaluated alternative strategies, and collaboratively proposed innovative solutions. They demonstrated a strong willingness to experiment with the provided datasets, testing different hypotheses and iteratively refining their models. This level of active participation and critical inquiry contrasts sharply with observations from traditional teaching methods, where students generally adopted a more passive role, focusing on listening and note-taking rather than engaging in problem-solving. The results suggest that situating learning activities within authentic financial contexts can substantially enhance both motivation and the development of practical analytical skills.

5.1.2. Skill improvement

Pre-post-course evaluations indicated a 23% increase in students' ability to develop AI models for financial applications, as reflected in the quality and technical accuracy of their projects. In the initial assessment, students' attempts to create AI models for financial risk analysis frequently exhibited errors in algorithm

selection and data preprocessing. By the end of the course, students were able to construct more accurate and efficient models, demonstrating improved judgment in choosing algorithms suited to specific financial datasets and greater attention to data cleaning and feature engineering. These improvements translated into a notable enhancement in overall project quality.

5.2. Continuous improvement mechanism

An outcome-focused review committee, composed of faculty, industry professionals, and alumni, meets twice a year to examine assessment results and refine learning outcomes. For instance, in response to emerging applications of generative AI in finance, the 2025 curriculum was revised to incorporate modules on large language models for financial report analysis, ensuring alignment with technological developments. Faculty members contribute their academic perspective, evaluating whether the course content effectively imparts the intended knowledge and skills. Industry professionals provide insight into current trends and practical competencies essential in fintech, while alumni offer reflections on the skills they have found most relevant in the workplace. The collaborative input from these three groups enables the curriculum to evolve continuously, enhancing its relevance to both students and the industry.

6. Conclusion

This study highlights the potential of Outcome-Based Education in reshaping AI instruction for fintech majors, fostering both technical expertise and interdisciplinary competence. By aligning the curriculum with clearly defined learning outcomes, embedding real-world applications, and employing interactive pedagogical approaches, the reform develops graduates capable of driving technological innovation in finance while upholding ethical and regulatory standards. Initial results from the pilot implementation indicate increased student engagement and measurable improvements in practical skills, providing preliminary evidence of the reform's effectiveness.

Ongoing refinement remains essential. The rapid evolution of fintech, including advances such as quantum-enhanced AI and decentralized finance applications, necessitates continual curriculum updates. Similarly, assessment frameworks must evolve to capture emerging competencies as the field advances.

Future research could examine the long-term impact of OBE on graduate career outcomes. Longitudinal studies may track how fintech graduates trained under this approach perform in professional settings, their capacity to adapt to new technologies, contribute to innovation, and assume leadership roles. Additional investigation into the scalability of this OBE-based model across other interdisciplinary financial programs could further enhance educational quality, offering insights for implementing similar reforms in courses such as blockchain applications or digital banking, and better preparing students for the dynamic fintech industry.

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Analysis of the Causes of the “Slow Employment” Group among College Students and Research on Precise Employment Promotion Strategies

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Abstract: This paper aims to deeply explore the causes of the “slow employment” phenomenon among college students and propose targeted and precise employment promotion strategies. Research suggests that “slow employment” is the result of the interwoven effects of multiple factors, including individuals, families, society, and the economy. Specifically, it is manifested in the transformation of college students’ career concepts towards “value realization”, the buffer space provided by family support, and the fluctuation of high-quality job supply due to macroeconomic structural adjustment. To address this challenge, this paper constructs a precise employment promotion strategy system with universities and the government as the main bodies, emphasizing the improvement of the efficiency of person-job matching through personalized employment guidance, deepening school-enterprise cooperation, optimizing policy supply, and resource integration. Finally, from the perspective of empirical analysis, this paper puts forward optimization suggestions such as establishing a dynamic early warning mechanism and improving the effect evaluation system, with the aim of providing theoretical references and practical paths for guiding the “slow employment” group to make rational plans and achieve smooth employment.

Keywords: Slow employment; Precise employment promotion; Cause analysis; Employment strategy; Employment of college students

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1. Introduction

The employment of college students is an important issue related to social stability and high-quality development. “Slow employment”, as a phenomenon that has become increasingly prominent among college graduates in recent years, has transcended the traditional category of unemployment and is manifested as a transitional state of actively or passively delaying entry into the labor market. This trend not only reflects the profound changes in the career values of the younger generation but also poses new challenges to the existing

employment service system and policy effectiveness. Current research needs to go beyond the description of phenomena, systematically analyze the multi-dimensional driving forces behind them, and construct effective intervention strategies. Based on this realistic background, this article first deconstructs the formation mechanism of the “slow employment” group from three aspects: individual psychological expectations, family and social environment, and macroeconomic policies. Furthermore, focusing on the concept of “precision”, this paper explores how universities and the government can achieve collaborative innovation in guidance services, platform construction, and policy support. Ultimately, through empirical analysis and evaluation, a data-driven decision-making basis is provided for optimizing employment promotion work, aiming to enhance the forward-looking and effectiveness of employment work.

2. Analysis of the causes of the “slow employment” group among college students

2.1. Personal factors and psychological expectations

Behind the phenomenon of “slow employment” among contemporary college students, changes in personal factors and psychological expectations have played a key driving role. With the improvement of material conditions and the general enhancement of educational levels, college students’ employment concepts have shifted from the traditional “survival employment” to “value employment” ^[1]. They are no longer content with merely finding a job to make a living, but pay more attention to personal interests, career development, and the realization of self-worth. When there is a significant gap between the actual position and the ideal expectation, some students would rather wait temporarily than “settle” for employment. In addition, in the face of fierce market competition, some students have significant anxiety about their abilities and lack of preparation. They feel that their knowledge reserves and practical skills are still insufficient to meet the challenges of the workplace. Therefore, they actively choose “slow employment” as a buffer period and enhance their competitiveness through means such as postgraduate entrance examinations, civil service examinations, and participating in skills training ^[2]. Meanwhile, the spread of negative information about the “996” work schedule and the pressure of internal competition in the workplace has also intensified the fear and evasion mentality of some graduates, making them resistant to directly entering society and inclined to reposition their life direction through a period of reflection and exploration. This kind of “Gap Year” choice is gradually evolving from an individual phenomenon to a transitional approach accepted by some groups.

2.2. Family support and social environment

As an important supporting system, the family’s concept and economic conditions provide a realistic possibility for “slow employment.” At present, the majority of college graduates are born in the 2000s, and their parents’ generation is mostly born in the 1970s ^[3]. The overall family economic capacity is relatively strong, and they can provide financial support for their children for a period of time after graduation, eliminating their sense of urgency to immediately seek employment to make a living. This “continuous supply” guarantee gives graduates a greater space for trial and error and confidence in making choices when choosing a career. In terms of mindset, many families have higher expectations for their children’s education and support them in pursuing higher academic qualifications through postgraduate entrance examinations, studying abroad, or preparing for “high-quality positions” within the system, such as civil servants and public institutions, even if it takes a longer time. From the perspective of the social environment, society’s

tolerance for diverse paths to success has increased. “Slow employment” is no longer simply equated with “unemployment” or “failure”, but is interpreted by some public opinions as a cautious and responsible attitude towards life ^[4]. Meanwhile, the new economic form has given rise to a large number of flexible employment forms, such as freelancing and the platform economy. The successful cases of these non-standard employment models have also imperceptibly changed society’s perception of traditional career paths, providing a legal basis and social atmosphere for various attempts during the “slow employment” period.

2.3. Economic situation and policy impact

The macroeconomic situation and industrial structure adjustment are the decisive forces shaping the basic situation of the job market, directly affecting the scale and structure of the “slow employment” group among college students. Against the backdrop of a shift in economic growth and increasing downward pressure, the capacity of some traditional industries to absorb employment has weakened. Meanwhile, the development of emerging industries is still in the process of cultivation and expansion. There is a phased contradiction between the number of high-quality positions they can provide and the rapidly growing number of college graduates, which has intensified the employment competition of “more monks than rice” and objectively prolonged the job-hunting cycle of some graduates. On the other hand, the vigorous development of the digital economy and platform economy, although creating new forms of employment, their unstable and temporary characteristics also make some graduates hesitate when facing choices, and they tend to spend more time observing and comparing ^[5]. From a policy perspective, the state has introduced a series of preferential policies to encourage college students’ employment and entrepreneurship, such as guaranteed loans for entrepreneurship and social security subsidies. However, it will still take time for these policies to be widely publicized and effectively implemented. Some graduates are not familiar with the details of these policies and do not make full use of them. At the same time, the expansion of higher education enrollment, while enhancing the quality of the nation’s citizens, has also led to changes in the relative value of academic qualifications in the job market. Some students, in order to stand out in the competition, have no choice but to extend their education years or invest more time in preparing for various qualification certifications, thus passively or actively joining the “slow employment” ranks.

3. Construction of precise employment promotion strategies

3.1. Personalized employment guidance services

The primary task in building a precise employment promotion system is to drive the transformation and upgrading of employment guidance services in colleges and universities from “broad-spectrum” to “personalized.” The traditional “flooding” style of employment guidance is no longer able to meet the diverse demands. It is necessary to establish a career development education system that runs through the entire university process. From the first year of college, scientific career assessment tools should be used to help students conduct self-awareness and career exploration, and clarify their initial development direction. For senior students, one-on-one career counseling and resume and interview guidance should be provided, with a focus on addressing the specific pain points they encounter during the job search process. For students with a tendency towards “slow employment”, the employment guidance center should take the initiative

to intervene. Through in-depth interviews, it should understand their core demands — whether it is due to ability panic, goal confusion, or overly high expectations. Based on this, personalized ability improvement plans or career exploration programs should be customized, such as recommending participation in short-term specialized skills training programs or arranging for experiential internships in related industries ^[6]. Mental health counseling should be strengthened to help students relieve employment anxiety and establish a positive job-hunting attitude. By establishing employment tracking files for graduates, continuous care and guidance are provided to students who have left school but are still unemployed, ensuring that employment services are not interrupted and effectively guiding them to smoothly transition from a “slow employment” state to a “fast employment” or “good employment” state.

3.2. School-enterprise cooperation and platform construction

To solve the problem of the mismatch between supply and demand of talents, deepening school-enterprise cooperation and building an efficient information platform are the core approaches. Colleges and universities should take the initiative to “go out”, establish strategic cooperative relations with key industries and leading enterprises, jointly design training programs, set up “order-based” training classes, and jointly build modern industrial colleges, seamlessly connecting industrial demands with the talent cultivation process, so that what students learn is highly consistent with market needs. Educators should vigorously expand high-quality internship and practice bases to ensure that students can gain valuable industry experience and job skills during their school years, and shorten the adaptation period after entering the workforce. At the same time, efforts should be made to actively “bring in”, regularly holding small-scale and precise job fairs by industry and major, inviting HR representatives from enterprises and alumni representatives to give lectures on campus, providing students with first-hand industry information and job-hunting experience ^[7]. In terms of digital platform construction, it is necessary to rely on big data and artificial intelligence technologies to create a smart employment service platform integrating job push, resume submission, policy consultation, and online guidance. This platform can intelligently analyze students’ professions, interests, and ability characteristics, precisely match them, and proactively push suitable internship and job positions. At the same time, it accurately recommends qualified candidates to the enterprise end, greatly improving the efficiency and success rate of person-job matching, breaking down information barriers, and pressing the “acceleration button” for graduates’ job hunting.

3.3. Policy support and resource integration

Precise and powerful policy support and resource integration at the government level are the guarantee for guiding and promoting the smooth employment of the “slow employment” group. Policy formulation needs to be more targeted. For instance, for micro, small, and medium-sized enterprises that absorb recent graduates, especially the “slow employment” group, greater tax reductions, social security subsidies, and job retention rewards should be provided to stimulate the enthusiasm of market entities to offer more job opportunities. For graduates who are flexibly employed or start their own businesses, the approval process should be simplified, policies such as entrepreneurship subsidies, guaranteed loans for entrepreneurship, and tax and fee preferences should be implemented, and convenient services such as personnel agency and social security continuation should be provided to eliminate their worries. It is necessary to enhance cross-departmental collaboration, integrate resources from various departments such as education,

human resources, and social security, and industry and information technology, and build a unified and interconnected national platform for graduate employment services, to centrally release authoritative job information, policy interpretations, and market trends^[8]. Encourage and support the participation of social forces, such as purchasing employment guidance services from professional human resource agencies and cooperating with well-known recruitment platforms to carry out special employment promotion activities, to form a joint force for employment promotion involving the government, universities, the market and society, and weave a comprehensive, multi-level and sustainable support network for “slow employment” graduates.

4. Empirical analysis and optimization suggestions

4.1. Data collection and case analysis

To ensure the effectiveness of the strategy, it must be based on solid empirical research. Detailed data on the “slow employment” group should be systematically collected through large-scale questionnaires, in-depth interviews, and big data analysis, including their family background, professional distribution, job-hunting process, psychological state, source of income, and final destination, etc. On this basis, representative positive and negative cases are selected for in-depth analysis. For instance, one can analyze the case of a student who successfully found a desired job through personalized guidance from the school, and summarize the key nodes and external supporting factors of their success. Study a case of a person who has long been in a state of “slow employment” and eventually fell into a difficult situation, and trace the decision-making misunderstandings and the missing links of external intervention^[9]. By making a horizontal comparison of the implementation effects of employment promotion strategies in different universities and regions, it is possible to identify which measures (such as precise school-enterprise cooperation projects and efficient smart employment platforms) have had a significant positive impact on promoting the employment of the “slow employment” group. This empirical analysis, based on data and cases, can effectively avoid subjective assumptions in strategy formulation and provide the most direct and reliable realistic basis for optimizing employment promotion work.

4.2. Evaluation of the implementation effect of strategies

Establishing a scientific evaluation system to continuously track and assess the effectiveness of precise employment promotion strategies is a key link in testing policy effectiveness and optimizing resource allocation. This assessment system should break through the traditional single dimension of “employment rate” and establish a comprehensive evaluation index that includes employment quality, matching efficiency, and group conversion. Specifically, it is necessary to focus on examining core indicators such as “person-job fit”, “graduate employment satisfaction”, “employer satisfaction”, “average job-hunting cycle”, and “conversion rate of slow employment groups.” By comparing the changing trends of these indicators before and after the implementation of the strategy, the actual effectiveness of each intervention measure can be quantitatively evaluated. Practice shows that scientific assessment requires the establishment of a regular data tracking mechanism. For instance, a certain university, through the analysis of user behavior on its smart employment platform, found that the accuracy of job matching after optimizing the algorithm had increased by 28%, and the conversion rate of resume submission had significantly improved. Meanwhile, a follow-up survey of graduates who have received personalized guidance services shows that over 85% of

the respondents believe that this service has effectively enhanced their career decision-making ability and confidence in job hunting ^[10]. This dynamic assessment based on big data can monitor the implementation effect of strategies in real time, promptly identify problems, and make adjustments. The assessment work should also focus on differential analysis, breaking down the data into different disciplines and student groups with different employment intentions, identifying the best applicable objects for various strategies, thereby providing precise data support and decision-making basis for subsequent policy optimization, and ensuring that limited resources can be invested in the most effective areas.

4.3. Future directions and improvement measures

Based on empirical analysis and effect evaluation, future employment promotion work needs to be deepened and innovated in the following aspects. The primary task is to establish a “warning-intervention” mechanism. By using students’ learning data, activity participation data, and career assessment data during their school years, a predictive model can be constructed to identify students at high risk of “slow employment” in advance and provide them with early care and proactive guidance. Secondly, efforts should be made to vigorously promote the professionalization of the employment guidance team. The career guidance capabilities of counselors should be enhanced through training and certification, and full-time career planners with industry background should be introduced. In terms of school-enterprise cooperation, it should shift from the construction of single internship bases to in-depth collaborative education, and jointly develop courses and certification systems that meet the demands of future industries. Finally, efforts should be made to actively explore the construction of a four-in-one linkage support system of “government—universities—social organizations—families”, especially to enhance communication between schools and the families of graduates, guide families to establish a rational employment outlook, and jointly create an inclusive, supportive and driving employment environment for graduates, thereby systematically reducing the negative impact of “slow employment.” Improve the overall quality and efficiency of employment.

5. Conclusions

This study systematically analyzed the complex causes of the “slow employment” phenomenon among college students and constructed a corresponding precise employment promotion strategy system. Research reveals that “slow employment” is a product of the joint shaping of personal value pursuit, family capital buffer, and macroeconomic environment, rather than the result of a single factor. Therefore, effective intervention must be based on the collaboration of multiple entities and the adoption of multiple measures. Based on this, the three strategies proposed in this paper, namely personalized guidance, in-depth cooperation between schools and enterprises, and precise policy support, form a comprehensive support framework ranging from micro individuals to the macro environment. Practice has proved that the key to promoting employment in the future lies in achieving a transformation from scale-oriented to a balance between quality and efficiency. The core is to rely on data-driven approaches, establish an early warning and dynamic assessment mechanism, and achieve the optimal allocation of resources. To guide the “slow employment” group to smoothly integrate into the labor market, it is not only necessary to enhance their own employment competitiveness, but also requires the joint efforts of the whole society to create an inclusive, supportive, and opportunity-rich employment ecosystem, so as to effectively transform the potential human resource reserves

into a strong driving force for social development.

Disclosure statement

The author declares no conflict of interest.

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AI-Enabled CLIL Model: Practical Pathways for Business English Listening Instruction in Universities

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Abstract: With the rapid development of AI technology and the continuous exploration of the “Content and Language Integrated Learning” (CLIL) model in the field of education, it has become particularly necessary to combine these two approaches for university business English listening instruction. Taking business English listening as an example, this paper explores the AI-enabled language teaching model and preliminarily investigates its advantages in improving students’ learning experience and integrating language with business knowledge. Based on this, the paper proposes a business English listening teaching model under a networked environment.

Keywords: AI-enabled; CLIL model; University business English; Listening instruction; Practical pathways

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1. Introduction

With the development of economic globalization, the importance of business English in international trade has been increasing. Listening is one of the most important skills in business English teaching, playing a significant role in students’ communicative abilities in business interactions and their future development. Traditional business English listening teaching methods generally suffer from limited teaching resources, monotonous teaching methods, and low student engagement. Content and Language Integrated Learning (CLIL) is a new approach that focuses on language learning and application in real-life contexts, effectively promoting students’ language skills and subject knowledge. The rise of AI technology has brought new opportunities to the education sector, providing students with personalized learning paths, timely feedback, and rich learning resources. Therefore, integrating AI technology into business English listening instruction can overcome the shortcomings of traditional teaching methods while fully utilizing their advantages, offering students more learning opportunities and enjoyment^[1].

2. Problems in traditional university business English listening instruction

2.1. Limited teaching resources

In traditional university business English listening instruction, teachers face significant limitations in obtaining and using teaching resources. During teaching, teachers often rely on a limited number of textbooks and fixed listening materials, which are often outdated and fail to reflect the current trends and real situations in international business. For example, emerging business models are often not mentioned in business English listening textbooks, causing students to acquire knowledge that is detached from real business contexts. Additionally, it is difficult for teachers to obtain a wide variety of listening resources in traditional listening instruction, which restricts the comprehensive development of students' listening abilities.

2.2. Monotonous teaching methods

Traditional business English listening teaching methods are relatively simple, with teachers playing recordings, students taking dictation, and teachers lecturing. This teaching approach lacks interactivity and fails to fully engage students in the learning process. For example, in English listening instruction, students often passively receive information without opportunities for independent exploration or collaborative learning. Moreover, a monotonous teaching method is difficult to adapt to the needs of different types of students, making some students feel bored and affecting their learning ^[2].

2.3. Low student engagement

In traditional university business English listening instruction, low student engagement is a problem that cannot be ignored. On one hand, the monotonous teaching methods provide few opportunities for student participation, which affects their enthusiasm for learning English listening. On the other hand, teachers often dominate the teaching process, leaving students with little opportunity to express their opinions. For example, after listening, teachers often only answer questions briefly without allowing students to participate in discussions or analyses. Therefore, how to improve students' listening levels is an important issue.

2.4. Lack of real-life context

In universities, traditional business English listening instruction often lacks real-life context support. Since most listening materials are processed and standardized, they differ greatly from real business communication. For example, in business English listening materials, content related to oral expressions in business negotiations, cultural differences, and how to handle emergencies is relatively rare. This teaching method, which lacks real-life context, makes it difficult for students to flexibly apply the knowledge they have learned in real life, thus affecting their listening levels ^[3].

2.5. Insufficient personalized instruction

In universities, traditional business English listening instruction is increasingly unable to meet students' personalized learning needs. Different classes have different English foundations, learning abilities, and learning styles, but traditional teaching methods often adopt a one-size-fits-all approach. For example, it is difficult for teachers to meet the needs of students with different levels, making it too easy for high-performing students while leaving behind those with weaker foundations. This teaching method is not conducive to the development of students' individuality or the full realization of their learning potential.

3. Advantages of an AI-enabled CLIL model in university business English listening instruction

3.1. Providing personalized learning experiences

The AI-enabled language teaching model can offer a highly personalized learning experience that is difficult to achieve in traditional teaching. The system uses big data analysis and machine learning methods to collect and analyze students' learning behaviors, listening levels, and progress in real-time. For example, the system can adjust the difficulty and content of the teaching materials according to students' actual situations, ensuring that each student can grasp the required knowledge at the most suitable level.

3.2. Enhancing the integration of language and business knowledge

The AI-enabled cross-cultural communication model integrates language learning with business knowledge, creating a more realistic learning context. Through AI technology, teachers can easily introduce various business scenarios and cases, such as international business negotiations, market research, and business seminars, allowing students to gain a deeper understanding of business operations and cultural backgrounds while learning a foreign language. For example, AI-based virtual reality (VR) can simulate business negotiation scenarios, enabling students to not only understand business English but also apply the business knowledge they have learned within enterprises.

3.3. Improving teaching efficiency and quality

The AI-enabled language teaching model can effectively enhance the effectiveness of university business English listening instruction. The system can play listening materials, assign homework, and grade assignments, significantly reducing teachers' workload. At the same time, it can provide students with immediate feedback and intelligent assessments, helping them better understand their learning status. For example, AI can use voice recognition technology to analyze students' pronunciation and intonation, offering more precise suggestions. Additionally, AI can provide teachers with detailed data analysis, enabling them to promptly grasp students' learning needs and difficulties, and adjust their teaching methods accordingly. Based on this, a data-driven teaching decision-making method is proposed to ensure the scientific and effective use of teaching content and methods, thereby improving the overall quality of education ^[4].

4. Practical pathways of the AI-enabled CLIL model in university business English listening instruction

4.1. Creating realistic business scenarios with AI technology

AI-based business English listening courses can utilize VR, AR, and other methods to construct highly realistic business environments. For example, teachers can use AI technology to simulate international business meetings, business negotiations, and product launches, allowing students to learn in immersive contexts. These scenarios not only provide students with authentic language environments but also deepen their understanding of business contexts and cultural differences. In this way, students can practice their listening skills in real contexts while acquiring business knowledge, achieving integrated learning of language and content.

4.2. Personalized learning paths and intelligent recommendations

The AI-enabled language model can offer personalized learning paths for students. Based on big data analysis and machine learning, AI can provide personalized learning based on students' listening levels, progress, and learning styles. For example, the system can analyze the types of errors and weaknesses students encounter during listening and provide targeted learning materials and exercises. On this basis, a personalized learning method is proposed, which can effectively improve students' learning outcomes and enhance their motivation. At the same time, it can adjust the teaching plan in a timely manner according to students' learning situations, ensuring that students maintain the best state at all times. In this way, teachers can pay more attention to each student's learning needs, achieving the goal of teaching according to individual aptitude.

4.3. Real-time feedback and intelligent assessment

The application of AI technology in business English listening instruction is also a very meaningful research topic. In traditional listening instruction, teachers often spend a lot of time grading listening assignments. AI can provide specific feedback immediately after students complete their tasks. Teachers' evaluations of students include not only answers to questions but also guidance on pronunciation, intonation, and vocabulary usage. For example, AI can use voice recognition technology to analyze students' pronunciation and intonation, pointing out areas for improvement. Additionally, the intelligent system can analyze students' assignments to generate learning reports, enabling teachers to better understand students' learning status. The real-time feedback and intelligent assessment mechanisms of this system help learners correct mistakes in a timely manner during class, thereby promoting their listening comprehension.

4.4. Promoting student collaboration and interaction

The AI-enabled language teaching model can effectively enhance students' collaboration and interaction skills. Using online teaching platforms and AI-driven collaborative teaching tools, students can engage in group discussions, role-playing, and project-based learning. For example, in a business negotiation listening exercise, students can collaborate in groups to complete tasks. This collaborative learning not only improves students' listening and speaking skills but also enhances their teamwork and cross-cultural communication abilities. Additionally, the system can facilitate collaboration between different groups based on complementary abilities and knowledge levels, allowing students to continuously improve through mutual exchange and achieve better learning outcomes.

4.5. Transformation of teachers' roles and professional development

In the AI-enabled CLIL teaching model, teachers' roles shift from being mere knowledge transmitters to becoming facilitators, guides, and promoters of learning. Based on this, through research on AI, teachers can better understand students' needs and difficulties in the learning process and make corresponding adjustments. For example, teachers can use learning reports generated by AI systems to identify common problems students encounter in listening and address them specifically in class. On this basis, combined with AI technology, teachers can conduct educational research to explore more effective teaching methods.

5. Conclusion

Therefore, the AI-enabled CLIL model offers a new opportunity for university business English listening

instruction. By establishing realistic business scenarios, providing personalized learning pathways, offering real-time feedback and intelligent assessment, promoting student collaboration and interaction, and facilitating the transformation of teachers' roles, this model can not only improve students' English listening skills and business knowledge but also enhance their interest and enthusiasm for learning. With the advancement of AI technology and the continuous updating of educational concepts, this model will be increasingly adopted by universities for business English teaching in the future, providing strong support for cultivating business professionals with an international perspective and cross-cultural communication skills.

Disclosure statement

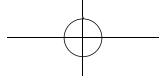
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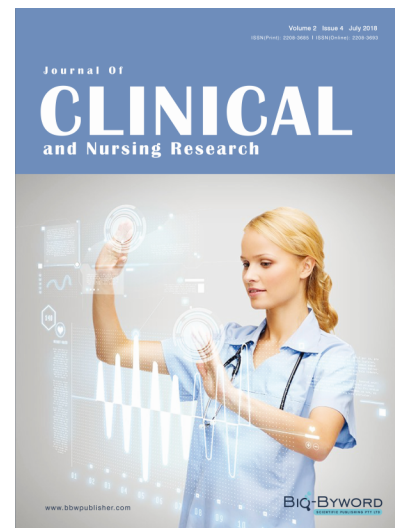
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