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CONTENTS

Sports Assistance Studios: Innovative Practices of NewEra Sports in Promoting Rural Revitalization and Social Equity

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Abstract: This paper focuses on sports assistance studios, an emerging social service model, and deeply explores their functions and values in promoting social equity and rural revitalization. By analyzing the operational mechanisms, development status, and practical cases of sports assistance studios, this study reveals their positive roles in improving the physical fitness of assisted groups, cultivating sports spirit, and enhancing social environments. Additionally, it proposes optimization strategies for existing challenges to provide theoretical references and practical guidance for the sustainable development of sports assistance studios. the research adopts a mixed method approach combining case studies, policy analysis, and social capital theory to systematically interpret the model's social significance.

Keywords: Sports assistance studios; Rural revitalization; Social equity; Sports education; Sustainable Development; Social Capital Theory

1. INTRODUCTION

1.1 Research Background

In the context of China's comprehensive promotion of the Rural Revitalization Strategy and the pursuit of common prosperity, sports, as a vital indicator of social development and human progress, play a unique role in narrowing urban rural gaps and promoting social equity. the 20th National Congress of the Communist Party of China emphasized the importance of "promoting the integrated development of urban and rural areas and narrowing the development gap, " while the State Council's National Fitness Plan (2021-2025) highlights sports as a key means to enhance national health and social inclusion. However, rural areas and vulnerable groups still face significant challenges in accessing sports resources. According to a 2024 report by the National Bureau of Statistics, the per capita sports venue area in rural China is only 62% of that in urban areas, and the coverage rate of professional sports instructors in poverty-stricken counties is less than 30%. Such disparities have prompted the exploration of innovative service models, such as sports assistance studios, which integrate social sports resources to provide targeted support.

1.2 Theoretical Framework

This study is rooted in three theoretical perspectives: Social Capital Theory (Putnam, 1993), which emphasizes the role of social networks and trust in promoting collective benefits. Sports assistance studios serve as platforms to build social capital by fostering interactions among diverse stakeholders. Capabilities Approach (Sen, 1999), which focuses on enhancing individuals' ability to act. By improving physical fitness and sports skills, these studios expand the capabilities of vulnerable groups. Sustainable Development Theory (Brundtland Commission, 1987), which advocates for balanced economic, social, and environmental development. Sports assistance studios contribute to sustainable rural development by combining physical health with cultural vitality.

1.3 Research Significance

Existing literature on sports for social good primarily focuses on largescale government programs or international nonprofit initiatives, with limited studies on grassroots innovative models like sports assistance studios. This research fills this gap by: Providing a theoretical framework for understanding the

social value of community-based sports services; Offering practical insights for policymakers and practitioners to optimize resource allocation; Contributing to the discourse on inclusive development by highlighting sports as a tool for social equity.

2. CONCEPTUALIZATION AND CHARACTERISTICS OF SPORTS ASSISTANCE STUDIOS

2.1 Definition

A sports assistance studio is a nonprofit organization established by multiple stakeholders—including governments, social organizations, and sports professionals—with a public welfare orientation. It integrates venues, teaching staff, and equipment to address the sports needs of specific vulnerable groups (e. g., rural adolescents, persons with disabilities, and residents of poverty-stricken areas). Services include personalized sports skill training, health guidance, and sports culture promotion, delivered through sustained programs.

This definition distinguishes sports assistance studios from traditional sports charities, which often rely on onetime donations, by emphasizing systematic, needs based intervention and long-term impact.

2.2 Core Characteristics

Targeted strategies are designed based on diverse group needs: For rural children, fun oriented sports curricula (e. g., nature-based obstacle courses) are developed to address low participation rates; For persons with disabilities, adaptive sports programs (e. g., wheelchair fencing, goalball for the visually impaired) are customized to accommodate physical limitations (World Para Athletics, 2023).

Stakeholder diversity is a key strength: Government agencies provide policy support and initial funding (e. g., local sports bureaus); Enterprises contribute through corporate social responsibility programs (e. g., sports equipment donations); Higher education institutions offer professional expertise, such as sports science faculty designing training programs; Community volunteers ensure ontheground implementation, often forming multigenerational service teams.

Service delivery is activity centered: Daily training programs follow scientific protocols, such as the Youth Physical Fitness Evaluation Standards; Regular competitions (e. g., township sports meet) create practical application scenarios; Health monitoring systems, including periodic physical examinations, link sports activities to health outcomes.

Longterm engagement is prioritized: "From giving fish to teaching fishing"—programs aim to cultivate lifelong exercise habits; Alumni networks are established to encourage peer support, such as former participants returning as coaches; Data tracking systems record participants' progress over years, enabling evidence-based program adjustments.

3. FUNCTIONS AND SOCIAL VALUES OF SPORTS ASSISTANCE STUDIOS

3.1 Enhancing Physical Fitness and Health

Scientific sports interventions have tangible health benefits. A 2023 study by the China Sports Science Institute found that rural adolescents participating in a three-year sports assistance program showed: 28% improvement in cardiovascular endurance; 19% increase in muscle strength; 32% reduction in myopia progression compared to control groups.

The physiological mechanisms include: Regular aerobic exercise improves oxygen uptake and reduces inflammation; Resistance training enhances bone density, particularly critical for growing children; Nutritional guidance integrated into programs (e. g., balanced diet workshops) complements physical activity.

3.2 Promoting Educational Equity and Talent Cultivation

For rural youth, sports assistance studios serve as bridges to educational opportunities: In Gansu Province's "Mountain Eagle" program, 37% of participants entered key middle schools through sports scholarships from 20212024; the program cultivates not only physical skills but also soft skills:

Teamwork (e. g., basketball leagues); Goalsetting (e. g., training plans); Stress management (e. g., post competition psychological counseling).

Bourdieu's cultural capital theory helps explain this: sports skills, often associated with urban elites, become a form of cultural capital that rural youth can leverage for social

mobility (Bourdieu, 1986).

3.3 Driving Rural Revitalization and Cultural Construction

Sports activities revitalize rural economies and cultures: Economic impact: A 2022 case in Zhejiang showed that annual village sports festivals attracted 12, 000 tourists, generating ¥3.2 million in local revenue; Cultural preservation: Traditional sports like dragon boat racing and shuttlecock kicking are incorporated into programs, preserving intangible cultural heritage;

Social cohesion: Communitywide sports events reduce "hollow village" effects by engaging migrant workers during festivals.

The Rural Revitalization Law of the People's Republic of China (2021) explicitly supports such initiatives, stating that sports should "promote rural spiritual civilization and industrial integration. "

3.4 Enhancing Social Inclusion and Equity

Sports assistance studios break down social barriers: A Beijing based adaptive sports studio for persons with disabilities reported:89% of participants reported increased social confidence; 62% established new social networks beyond their disability communities; Mixed ability sports events (e. g., inclusive badminton tournaments) challenge stereotypes and promote empathy. This aligns with the UN's Sustainable Development Goal 10 (Reduced Inequalities), as sports serve as a universal language to foster social integration (UN, 2030 Agenda).

4. CASE STUDIES OF SPORTS ASSISTANCE STUDIOS

4.1 "Mountain Village Young Eagles" Sports Assistance Program

Launched in 2020 by the China Youth Development Foundation in southwestern China's Yunnan Province, the program targets children aged 815 in mountainous areas with limited educational resources. the goal is to improve physical health and create educational pathways through sports.

Partnerships: Local schools provide venues, provincial sports universities dispatch student coaches (200 volunteers annually), and corporate sponsors fund equipment;

Curriculum: Weekly 90minute sessions: basketball, track and field, traditional folk sports; Annual camps: 10day intensive training with professional athletes; Health tracking: biannual physical exams and nutrition workshops.

After three years (20202023): Physical fitness pass rate increased from 52% to 92% ($p<0.01$); 28 students were admitted to key middle schools via sports scholarships; Parental awareness of sports' educational value rose from 31% to 79% (survey data).

The program innovates through "Sports+Education" integration, with coaches also providing homework guidance, addressing both physical and academic needs.

4.2 Adaptive Sports Studio for Persons with Disabilities

Established in 2019 by the Shanghai Disabled Persons' Federation in collaboration with East China Normal University, this studio aims to promote social inclusion through adaptive sports for 1660yearolds with physical disabilities.

Professional team: 15 certified adaptive sports instructors, 5 physiotherapists, and 3 psychologists;

Programs: Wheelchair basketball (3 times/week); Visually impaired orienteering (2 times/month); Adaptive swimming (group and individual sessions); Community integration: Monthly joint events with able-bodied sports clubs.

91% of participants reported improved motor function (assessed by physiotherapists); 73% joined community sports groups outside the studio; 45% secured parttime jobs related to sports (e. g., coaching, event organizing).

The studio uses virtual reality (VR) technology for training, such as VRbased obstacle courses for visually impaired athletes, enhancing accessibility and engagement.

5. CHALLENGES IN THE DEVELOPMENT OF SPORTS ASSISTANCE STUDIOS

5.1 Funding and Resource Constraints

Dependence on government grants: 68% of studios rely on short-term project funding (2024 survey by China Charity Information Center); Unstable social donations: Only 12% of studios have consistent corporate sponsorships; Resource gaps: 43% of rural studios lack basic equipment (e. g., standard sports mats), and 56% have inadequate venue space. This reflects broader challenges in

China's nonprofit sector, where social organizations often struggle with financial sustainability (Wang, 2022).

5.2 Shortage of Professional Talent

Supply demand gap: China has only 8, 700 certified sports rehabilitation professionals for 85 million persons with disabilities (China Rehabilitation Research Center, 2023); High volunteer turnover: 65% of student volunteers serve for less than six months, disrupting service continuity; Skill mismatch: Many grassroots coaches lack training in adaptive sports or rural youth education.

5.3 Inadequate Long-term Mechanisms

Project based mentality: 59% of studios focus on short-term events (e. g., single day sports festivals) over sustained programs (Ministry of Civil Affairs report, 2023); Limited data management: Only 21% of studios maintain systematic participant records for long-term evaluation; Weak alumni networks: Fewer than 10% of studios have formal mechanisms to engage past participants.

5.4 Low Public Awareness and Participation

Misconceptions: 63% of the public perceives sports assistance as "recreational activities" rather than social services (2024 public survey); Low engagement: Average volunteer participation rate is 0.8% of the local population in target areas; Media coverage: Only 3% of national sports news focuses on grassroots assistance programs.

6. OPTIMIZATION PATHWAYS FOR SPORTS ASSISTANCE STUDIOS

6.1 Building a Pluralistic Resource Integration Mechanism

Public private partnership (PPP) model: Learn from the U. S. Sports Philanthropy Network's model, where corporations receive tax incentives for sports charity donations; Develop sports themed social enterprises, such as producing ecofriendly sports equipment for rural schools, generating sustainable income.

Resource sharing platforms: Establish regional sports resource banks to circulate unused equipment between studios; Partner with universities to use sports science labs for free health assessments.

6.2 Strengthening Professional Talent Cultivation

Academic programs: Collaborate with universities to offer bachelor's degrees in "Sports Assistance and Social Work, " as pioneered by Beijing Sport University in 2024; Provide on-the-job training for grassroots coaches, certified by the National Sports Administration.

Volunteer management: Implement a "mentorship system" where experienced volunteers train newcomers; Offer nonfinancial incentives, such as university credit for student volunteers or public recognition ceremonies.

6.3 Improving Long-term Management and Evaluation Systems

Standardized service processes:

Develop industry guidelines covering needs assessment, program design, and impact evaluation, modeled on the ISO 20121 event sustainability standards;

Use cloud-based management systems to track participants' lifelong sports trajectories.

Third-party evaluation:

Engage independent research institutions to conduct annual impact assessments;

Publish transparent reports to build donor trust, as done by the International Sport and Culture Association.

6.4 Enhancing Promotion and Brand Building

Digital storytelling: Produce short documentaries on participants' transformations, shared via TikTok and YouTube; Launch social media campaigns (e. g., SportsForAllChallenge) to raise awareness.

Brand differentiation: Create recognizable brand identities, such as the "Golden Phoenix" logo for rural women's sports programs; Host annual national sports assistance summits to showcase best practices.

7. CONCLUSION

Sports assistance studios represent an innovative model for leveraging sports to address social inequalities in China's rural revitalization drive. Through case studies and theoretical analysis, this paper has demonstrated their multifaceted values in promoting physical health, educational equity, rural development, and social inclusion. Despite challenges in funding, talent, and sustainability, the model's potential is evident in its ability to empower vulnerable groups

and build inclusive communities.

Future research should explore: the impact of digital technologies (e. g., AIbased fitness apps) on sports assistance; Crosscultural comparisons with international community sports models; The role of sports assistance in addressing emerging social issues, such as youth mental health. As China strides toward common prosperity, sports assistance studios can serve as vital platforms to ensure that the benefits of development are shared equitably, embodying the principle that "sports for all" is not just a slogan but a pathway to social justice.

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On the Management of Contract Archives

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Abstract: As a contract for unit business processing, contracts are the main guarantee for unit operations, so the management of contract archives is of great significance. As a special way of archive management, contract archive management has unique characteristics. Based on the analysis of the prominent problems in contract archive management at present, this article attempts to propose relevant countermeasures and measures, in order to improve the level of contract archive management and safeguard the healthy operation of units.
Keyword: Main issues and improvement measures in contract archive management

1. INTRODUCTION

Contract archives are the data and text used in the process of contract signing, performance, modification, transfer, and termination, and are a true reflection of the establishment, modification, and termination of civil relationship agreements between the parties. As an important basis for the operation of a unit, contract archives can not only provide important guarantees for business management, but also provide data reference for decision-making. As archival materials during the contract process, it is an important basis for resolving contract disputes, conducting legal judgments, and contract arbitration. It guides and regulates the behavior of contract parties, reduces the arbitrariness and blindness of contract performance, avoids unnecessary errors and errors, and avoids economic losses.

2. UNIQUE CHARACTERISTICS OF CONTRACT ARCHIVES

Based on the important role of contract archives. In addition to its general archival characteristics, it also has the following characteristics:

2.1 Legality

The content of contract archives is a legally protected and established contract, so contract archives have stronger legal significance compared to general archives. the main manifestation is that the preservation, management, and even destruction of contract archives must be strictly carried out in accordance with relevant legal procedures.

2.2 Normativeness

The format of the contract determines that the content and management of the contract archives must be standardized. Firstly, in terms of content, a complete contract archive must include legal content, the signatures of the parties, the number of contracts, etc., none of which is indispensable. In the process of managing contract archives, it is also necessary to strictly follow relevant regulations to ensure their integrity. the damage or absence of a contract will affect its legal validity.

2.3 Complexity

The contract involves all aspects of the daily operation of the unit, and the key information of various departments such as procurement, quality, and assets is organically linked through the contract archives. Therefore, the management of contract archives is complex and requires a large workload.

3. PROBLEMS IN CONTRACT ARCHIVE MANAGEMENT

3.1 Insufficient emphasis on contract archive management

In real life, due to weak legal awareness and the influence of outdated concepts, people have insufficient understanding of contract archives management work, and their awareness of contract archives is weak. In work, "interpersonal relationships" replace legal relationships, contract formats that do not meet legal requirements, and contracts that are only signed but not stored, lost, or even leaked are repeatedly prohibited. Due to the lack of specialized contract archive management standards and methods in the country, the inspection, supervision, guidance, and management of contract archives by units

are insufficient, and the management responsibilities are unclear. Contract archives do not have the conditions for safe storage.

3.2 Difficulty in collecting contract archives

As a "gender" document that combines document archives and technological archives, contracts lack clear filing standards and involve different departments and various processes in the processing, making them the most easily lost and difficult to control document. Some units do not have a dedicated contract archive management department. Even if a dedicated department is established, it is difficult for archive personnel to timely grasp the contract signing status due to the scattered contracts between different departments, and they cannot track it in a timely manner. Some handling departments, in order to facilitate or busy with daily work, arbitrarily store contracts in their own hands, resulting in delayed contract archive archiving.

3.3 Low level of networking and informatization

Traditional paper contracts are not easy to preserve, are easily stained, damaged, and have a large workload, cross time, complex content, and low efficiency. With the development of computer network technology, informatization has also been introduced into the management of contract archives. However, due to the development period, low technical level, and lack of professional personnel, the level of informatization and networking in contract archive management is not high.

4. MEASURES TO IMPROVE THE MANAGEMENT LEVEL OF CONTRACT ARCHIVES

In response to the main problems currently existing in contract archives, we can improve the management of contract archives from the following aspects.

4.1 Enhance employees' awareness of the rule of law in their archives

By strengthening the study and promotion of the Contract Law and the Archives Law, we aim to improve the legal literacy of employees, enhance their understanding of the importance of contract archive management, create a good environment for conscientiously implementing contract archive management, form a work discipline and atmosphere of conscious, purposeful, and conscious accumulation, and transfer archives according to regulations, and incorporate contract archive management into the legal management track. Contract management personnel are familiar with legal knowledge such as the Contract Law, and handle affairs in accordance with the law in the early, mid-term, and later stages of contract signing to ensure the rationality and legality of the contract. Archives management personnel should strictly follow laws and regulations in their daily work to ensure the complete collection and standardized management of contract archives.

4.2 Improve the relevant system of archive management

Units should make archive management an important part of their work in accordance with relevant national regulations, clarify responsibilities, and conscientiously implement them. All competent departments and contract and archive management departments shall closely cooperate and jointly develop comprehensive contract and archive work standards and methods to ensure that contracts have the value of archiving and reference. the management system, responsibilities, forms, and contents of contract and archive management shall be clearly defined, so that archive management work has rules to follow. A tracking and assessment system and registration system for contract and archive departments shall be established to ensure timely submission of contract and archive documents Safe storage.

4.3 Improving the Professional Level of Archivists

Clarify the specific responsibilities of contract management personnel and archive management personnel, cultivate a group of full-time and part-time archive management personnel who understand both department business and archive management knowledge through centralized training, professional learning, and other methods, improve their sense of ownership and professional level and work skills in contract archive management, and make them high-level archive management workers. At the same time, improve the informatization level of contract archive management personnel, use modern tools to do a good job in numbering and

classifying contract archives, and be able to handle contract archive management work in a timely, efficient, and convenient manner.

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Research on the Connotation and Path of Smart Curriculum Construction in Undergraduate Colleges

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Abstract: Smart curriculum construction is an important driver of the digital transformation of higher education. By deeply integrating advanced information technologies, it aims to systematically restructure the design, implementation, and evaluation systems of courses. Currently, Chinese universities are facing the dual pressure of teaching model reform and quality enhancement. Smart curriculum provides a new approach to achieving educational equity, improving teaching efficiency, and promoting personalized learning. Based on national policy guidance and typical case studies from universities, this paper systematically analyzes the connotation, characteristics, and core elements of smart courses. It proposes a construction framework centered on digital resources, intelligent teaching, diversified evaluation, and innovative content. Furthermore, the paper explores practical implementation paths from four dimensions: the reconstruction of teaching scenarios, personalized support, industry-education integration, and teacher development. Finally, targeted strategies are proposed to address practical challenges such as technological compatibility, teacher digital literacy, and data ethics, aiming to provide theoretical support and operational guidance for smart curriculum development in undergraduate institutions.

Keywords: Smart Curriculum; Higher Education; Digital Transformation; Artificial Intelligence; Teaching Innovation

1. INTRODUCTION

With the rapid evolution of information technology, particularly the widespread application of artificial intelligence (AI), big data, cloud computing, and the Internet of Things (IoT), the education sector is undergoing profound transformations. Traditional teaching models centered on "teacher-led instruction and passive student reception" struggle to meet the demands of high-quality, personalized, and lifelong learning in the new era. Higher education is gradually transitioning from knowledge dissemination to competency development and literacy enhancement, while curriculum construction is shifting fundamentally from "content-centered" to "student-centered" approaches.

Intelligent curriculum construction has emerged in this context. By leveraging technological tools to comprehensively upgrade course resources, teaching methods, evaluation mechanisms, and content systems, it serves as a critical breakthrough for universities to address digital challenges and improve educational quality. Particularly in the post-pandemic era, the normalization of hybrid online-offline teaching has further highlighted the vital role of intelligent courses in achieving educational flexibility, interactivity, and broad accessibility.

This paper will analyze the essence of intelligent curriculum construction, explore its core elements, implementation pathways, and practical challenges, and propose a replicable framework to support the high-quality development of undergraduate institutions.

2. CONNOTATION AND CORE ELEMENTS OF INTELLIGENT CURRICULUM CONSTRUCTION

Intelligent curriculum construction transcends mere "digitization" of courses. It represents a learner-centered, technology-integrated, and data-driven systemic reform. Its core features

extend beyond technological applications to encompass deep transformations in educational philosophy, pedagogical organization, and talent development objectives. Key elements include:

2.1. Digitalization of Course Resources

Digital course resources form the foundation of intelligent curriculum development. This includes not only electronic textbooks but also multimedia teaching cases, virtual simulation platforms, and standardized, structured resource management. Digital resources enable anytime-anywhere access, personalized customization, and dynamic updates.

For instance, Shenyang Aerospace University's "Shenhang Zhishu" system, developed using large-scale AI models, maps abstract mathematical concepts, formula derivations, and engineering applications via knowledge graphs, helping students visualize knowledge structures and enhance cognitive efficiency. Similarly, Chengdu Industrial College's "Chenggong Zhixue" platform hosts over 700 in-house courses across science, engineering, humanities, and arts, enabling centralized management and open sharing of high-quality resources.

Digitalization also facilitates cross-platform resource migration and inter-institutional sharing, laying the technical groundwork for national credit recognition systems and "Internet+Education" initiatives.

2.2. Intelligent Teaching Methods

Traditional teaching often lacks real-time insights into individual student progress and personalized feedback. Intelligent courses address this by embedding AI and learning analytics to achieve data-driven, refined, and adaptive instruction.

Northeastern University's "Intelligent Teaching Platform" exemplifies this approach. By analyzing student behavior data—such as video viewing duration, exercise accuracy, and response speed—the platform constructs learner profiles and delivers personalized learning paths and recommendations, enabling tailored education.

At the K-12 level, Enshi City's "Class Optimization Master" employs AI-driven incentive and feedback systems to boost student engagement, offering insights for higher education institutions. Universities must ensure that AI-driven analytics align with pedagogical logic and ethical standards while adopting such tools.

2.3. Diversified Evaluation Systems

Traditional evaluation overemphasizes exam scores, neglecting the development of critical thinking, practical skills, and innovation. Intelligent curricula adopt holistic, process-oriented, and developmental assessment systems to comprehensively track student growth.

For example, Changsha's "Renren Tong Space" platform integrates homework completion, activity participation, and health metrics into evaluations, generating personalized growth reports. Dongguan Songshan Lake Experimental Middle School applies multiple intelligences theory to assess students across dimensions like logical reasoning, language expression, and spatial thinking.

In higher education, diversified evaluation combines formative assessments (e. g., online quizzes, project reports, classroom participation), peer reviews, and teacher evaluations, transforming assessment into a tool for continuous improvement rather than a terminal judgment.

2.4. Innovative Course Content

Content innovation is the soul of intelligent curriculum construction. Rapid technological advancements demand that courses integrate emerging knowledge, technologies, and scenarios to stay aligned with industry needs.

Xuchang University's "1+N+X" curriculum system exemplifies this. Centered on a core interdisciplinary course, it incorporates modules on AI, blockchain, and smart manufacturing, fostering students' cross-disciplinary integration and application skills.

Content innovation also manifests in "problem-based" and "project-based" tasks, shifting focus from knowledge transmission to guided inquiry and collaborative problem-solving.

3. IMPLEMENTATION PATHWAYS FOR INTELLIGENT CURRICULUM CONSTRUCTION

As a systemic project, intelligent curriculum construction involves course design, pedagogical organization, technical support,

and management mechanisms. Key pathways include:

3.1 Technological Reconfiguration of Teaching Scenarios

Intelligent tools and immersive technologies like VR/AR enhance interactivity and engagement. Chengdu Industrial College's "Chenggong Zhixue" platform integrates AI-powered question generation, error analysis, and knowledge graph tools to personalize learning paths. Jiangxi Province's "Smart Homework" platform uses AI to create personalized error logs and deliver targeted exercises.

3.2 Data-Driven Personalized Learning Support

Intelligent courses prioritize data-driven decision-making. For example, "Shenhang Zhishu" dynamically monitors learning paths and provides tailored exercises, while generating "class radar maps" to help teachers identify gaps. China's "National Credit Bank" initiative further supports flexible, personalized learning through cross-institutional resource sharing and certification.

3.3 Industry-Education Integrated Curriculum Ecosystems

Collaboration with industry bridges the gap between academia and real-world needs. Northeastern University's "Technology Demand Committee" co-designs courses with enterprises to address practical challenges. Xuchang University's three-tier project-based system transforms corporate projects into teaching tasks across coursework and capstone projects.

3.4 Faculty Digital Literacy and Team Collaboration

Teachers' digital competencies are pivotal. Hebei Medical University trains faculty in AI-assisted tools and knowledge graph development, empowering them as curriculum designers. Cross-disciplinary teams—combining subject experts, engineers, and evaluators—are essential for course development.

4. CHALLENGES AND STRATEGIES

Key challenges include:

4.1 Technical Compatibility and Resource Fragmentation

Redundant platforms and disjointed systems hinder efficiency. National initiatives like China's "Four Horizontal, Five Vertical" smart education platform exemplify unified planning and resource integration.

4.2 Faculty Digital Literacy Gaps

Hierarchical training systems (basic-advanced-exemplary) can motivate faculty upskilling.

4.3 Data Ethics and Privacy Risks

Strict adherence to data protection laws, anonymization protocols, and algorithmic transparency is critical to mitigate risks.

5. CONCLUSION

Intelligent curriculum construction is pivotal for universities to achieve high-quality development. By centering on students and leveraging systemic innovation in resources, methods, evaluation, and content, it fosters flexible, precise, and efficient educational ecosystems. Future efforts should explore hybrid "AI assistant+teacher-led" models, policy refinement, and inter-institutional collaboration to advance educational equity, quality, and modernization.

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Role and Mechanism of N6-methyladenine (m6A) in Regulating VEGFA Expression to Promote Bone Metastasis in Lung Cancer

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Abstract: Bone is one of the common sites of distant metastasis of lung cancer, and a series of complications caused by bone metastasis seriously affect the mobility and quality of life of patients. Currently, the main treatment for bone metastasis is palliative treatment, which is still unsatisfactory and the survival benefit of patients is still limited. Therefore, exploring new mechanisms of lung cancer bone metastasis is expected to provide theoretical basis and therapeutic targets for inhibiting or blocking lung cancer bone metastasis. In recent years, the role of epigenetics in the development of lung cancer has received more and more attention, and the relationship between histone modifications and various biological behaviors of lung cancer, including proliferation, drug resistance, and metastasis, is one of the hot spots of research. Histone modifications can significantly activate or inhibit the transcription of downstream target genes and thus promote or inhibit different aspects of lung cancer bone metastasis. 6-methyladenine (m6A) is the most abundant modification on mRNA, which is widely found in prokaryotic and eukaryotic organisms. Previous studies have shown that m6A plays an important role in the regulation of multiple aspects of mRNA biology, and m6A methylation modifications are present in the 5'UTR, CDS, and 3'UTR of VEGFA, which may regulate VEGFA by affecting variable shear, mRNA stability, IRES, uORF, and miRNA binding, miRNA binding, etc. It may regulate VEGFA expression by affecting variable shearing of VEGFA, mRNA stability, IRES, uORF, miRNA binding, etc. Therefore, the study of the effect of m6A on the generation of VEGFA isoforms and the role of methylation in promoting bone metastasis, and the clarification of whether METTL3 has the function of promoting bone metastasis in lung cancer, can provide a reference for the clinical diagnosis and treatment of bone metastasis in lung cancer.

Key words: N6-methyladenine (m6A); VEGFA; Bone Metastasis; Lung Cancer.

1. SECTION1. BACKGROUND

Bone is one of the common sites of distant metastasis of lung cancer, about 36% of lung cancer patients can be found bone metastasis in autopsy, and 25% of bone marrow micrometastasis. 48% of non-small cell lung cancer (NSCLC) and 40% of small cell lung cancer (SCLC) patients develop bone metastasis at the time of initial diagnosis, and the median time between diagnosis of lung cancer and development of bone metastasis is 19 months, the median time to the first occurrence of skeletal related events (SREs) in lung cancer bone metastasis was 9.5 months, and the median survival of patients with bone metastasis was only 6-10 months. [1] Bone metastases from lung cancer are commonly osteolytic metastases, which occur in the proximal part of the spine and trunk, and a series of complications caused by bone metastases seriously affect the mobility and quality of life of patients [2]. Currently, the mainstay of treatment bone metastasis are radiotherapy, anti-osteoporotic drugs, surgical intervention, chemotherapy and other palliative treatments, which are still not satisfactory and the survival benefit of patients is still limited[3]. Therefore, exploring the new mechanisms of lung cancer bone metastasis is expected to provide theoretical basis and therapeutic targets for inhibiting or blocking lung cancer bone metastasis.

In recent years, the role of epigenetic inheritance in the development of lung cancer has received more and more attention, and the relationship between histone modification and

various biological behaviors of lung cancer, including proliferation, drug resistance and metastasis, is one of the hot spots of research. Currently, the known types of histone modifications mainly include methylation, acetylation, phosphorylation, ubiquitination and other modifications of histones. the histone modifications can significantly activate or inhibit the transcription of downstream target genes and thus promote or inhibit different aspects of lung cancer bone metastasis.

6-Methyl adenine (m6A) is the most abundant modification on mRNAs, and it is widely found in prokaryotes and eukaryotes [4]. There are more than 12, 000 m6A modification sites and more than 7, 000 genes modified on human mRNAs, and its dynamic regulation is mainly dependent on three types of related proteins:reader, writer, and eraser [5]. the m6A recognition proteins are mainly YTH domain-containing proteins such as YTHDF1/2/3, YTHDC1/2, and members of the IGF3BPs family; RNA m6A methylation enzymes are mainly METTL3/14 and WTAP, which transfer methyl from the methyl donor S-adenosylmethionine (SAM) and catalyze the formation of m6A in the RNA; and demethylation enzymes include FTO and ALKBH5, which belongs to the Alkb family [6].

Studies have shown that m6A modifications play an important role in tumor progression, with Mettl3 promoting tumor metastasis by promoting epithelial mesenchymal stromatization (EMT) in tumor cells and translation of the key transcription factor Snail [7] . In addition, the methylase Mettl3 promotes the proliferation and clone formation of hepatocellular carcinoma cells through YTHDF2-mediated silencing of SOCS2 [8]. Recent studies have shown that bone metastasis in NSCLC is significantly correlated with EMT [9]. Therefore, it is likely that Mettl3 promotes metastasis of NSCLC cells by inducing EMT.

Neovascularization provides oxygen and nutrients necessary for tumor growth, which in turn promotes tumor spread and metastasis, such as bone metastasis in lung cancer patients [10]. Vascular Endothelial Growth Factor (VEGF) is the most potent and specific pro-angiogenic factor known to date, and VEGFA plays a critical role in angiogenesis [11]. It can mediate angiogenesis through specific binding to vascular endothelial cell receptor (VEGFR) on endothelial cells [12]. Previous studies have shown that VEGFA may be closely related to bone metastasis in lung cancer, with more than 70% of NSCLC patients having high expression of VEGFA, and the rate of bone metastasis was significantly higher in patients with positive expression of VEGFA than in those with negative expression [13]. Does the methylase Mettl3 promote bone metastasis in lung cancer by regulating VEGFA expression?

The human VEGFA gene is located on chromosome 6p21, with a total length of 28 Kb and a coding gene length of 14 Kb, consisting of 8 exons and 7 introns [14]. VEGFA can exist in various forms of shears. According to the molecular weight, it can be classified as VEGF111, 121, 145, 162, 165, 183, 189 and 206, of which 121, 165 and 183 are the main forms [12]. Studies have shown that there are significant differences in the functions of VEGFA in different shear forms: VEGFA-189 is thought to inhibit angiogenesis and exert antitumor effects [15]. VEGFA-165, on the other hand, has been sthought to promote angiogenesis and malignant progression of tumours[16] . Secondly, the mRNA stability of VEGFA is regulated by multiple factors: the 3'UTR of VEGFA mRNA contains multiple AU rich elements (AREs) [17, 18]. In addition, proteins such as MDM2 can increase their mRNA stability by binding to the AREs in the 3'UTR [19].

Previous studies have shown that m6A plays an important role in the regulation of multiple aspects of mRNA biology, and there are m6A methylation modifications in the 5'UTR, CDS, and 3'UTR of VEGFA, which may regulate VEGFA expression by affecting the variable shear of VEGFA, mRNA stabilization, IRES, uORF, and miRNA binding, etc.

Therefore, investigating the effect of m6A on VEGFA isomers mediating the role of methylation in promoting bone metastasis, and clarifying whether METTL3 has the function of promoting bone metastasis in lung cancer can provide a reference for the clinical diagnosis and treatment of lung cancer bone metastasis.

2. RESEARCH METHODOLOGY

2.1 To clarify whether METTL3 promotes VEGFA expression and its molecular mechanism.

2.1.1 Immunoprecipitation (IP): Total proteins were extracted from lung cancer cell line A549, and the proteins obtained by IP and Co-IP were used to verify the interaction between METTL3 and VEGFA by Western blot.

2.1.2 Silencing of c-Myc: the expression of c-Myc was transiently knocked down in A549 cells by siRNA transfection. qRT-PCR and Western blot were used to verify whether METTL3 is dependent on c-Myc to promote the transcription and expression of VEGFA.

2.1.3 Chromatin immunoprecipitation (ChIP):

2.1.3.1Sequences predicting the possible binding of METTL3 to the VEGFA promoter region were analyzed online at genome. ucsc. edu and used to design PCR primers and verify the specificity of the primers.

2.1.3.2The expression level of METTL3 was transiently knocked down in lung cancer cell line $A549^{BM}$ by siRNA targeting METTL3, and then the enrichment of METTL3, c-Myc and other proteins upstream of the VEGFA promoter was analyzed by CHIP-PCR assay after knocking down METTL3. To verify whether METTL3 promotes VEGFA transcription by promoting histone methylation in the upstream region of the VEGFA promoter and recruiting c-Myc to the VEGFA promoter region.

2.2 To study the specific aspects of METTL3 in promoting bone metastasis in lung cancer.

2.2.1 Silencing and overexpression of METTL3:

The expression level of METTL3 in lung cancer cell lines and cell sublines with different bone metastatic abilities was detected by WB, and the expression of METTL3 in A549 was silenced by siRNA transient transfection and shRNA lentivirus infection. By lentiviral infection, $A549^{BM}$ with stable overexpression of METTL3 was constructed, and the knockdown and overexpression efficiency was verified by RT-qPCR method, and the treatment was used for subsequent experiments.

2.2.2 Transfer invasion in vitro functional experiments:

2.2.2.1 In the established lung cancer cell lines with stable overexpression or silencing of METTL3, the effects of knockdown or overexpression of METTL3 on the migration ability of lung cancer cells were examined by using the scratch healing assay and Transwell migration assay;

2.2.2.2 The effect of METTL3 on the invasion ability of lung cancer cells was analyzed by 3D cell culture assay as well as Transwell invasion assay;

2.2.2.3 The changes in E-cadherin and N-cadherin protein expression levels after knockdown or overexpression of METTL3 were detected by WB and immunofluorescence techniques;

2.2.2.4 Lung cancer cells stably overexpressing or knocking down METTL3 were co-cultured in chambers while osteoblasts were placed outside the chambers to test whether METTL3 affects osteoblast chemotaxis toward lung cancer;

2.2.2.5 Lung cancer cells stably overexpressing or knocking down METTL3 and the corresponding control group were placed in Transwell chambers, and macrophages were placed in the chambers, and the number of macrophages passing through the chambers was counted after 48h, to verify whether METTL3 affects the chemotaxis of lung cancer cells to macrophages;

2.2.2.6 Stable overexpression or knockdown of METTL3 and corresponding control lung cancer cells were co-cultured with vascular endothelial cells to test whether METTL3 affects angiogenesis.

3. EXPECTED CONCLUSION

Through the above-mentioned research, this study clarifies the regulatory role of m6A modification in the generation of VEGFA isoforms and the molecular mechanism by which it mediates methylation-promoted bone metastasis. Meanwhile, it elucidates the functional effects of METTL3 in the progression of bone metastasis in lung cancer, providing a theoretical basis and potential targets for the clinical precision diagnosis and treatment of bone metastasis in lung cancer..

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Practice and Exploration of the Modernization and Transformation of University Archives Management - Based on the Perspective of Digitalization and Governance Efficiency Improvement

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Abstract: University archives are historical records of education and teaching, scientific research practice and management services, carrying the important mission of university spiritual inheritance and academic accumulation. In the digital era, traditional university file management is facing challenges such as inefficient resource integration, single service mode, and lagging technology application. This paper takes the modernization and transformation of university archives management as the research object. By analyzing the current management situation and actual needs, it explores the path of digital technology to empower the development of archives resources, the optimization of governance system and the improvement of service efficiency. Combined with specific practical cases, it puts forward the innovative strategy of the trinity of "technology-system-service" to provide theoretical reference and practical reference for the high-quality development of college archives management.

Keywords: College Archives Management; Digital Transformation; Governance Efficiency; Resource Development

1. INTRODUCTION

As the core position of talent training, scientific research and social services, colleges and universities cover teaching evaluation, scientific research achievements, teacher-student data, school history and culture and other diversified contents, which is an important part of the university governance system. With the promotion of the Education Informatization 2.0 Action Plan and the "14th Five-Year Plan" National Archives Development Plan, digital transformation has become an inevitable choice for college archival management to break through traditional bottlenecks and improve governance efficiency. However, at present, there are still problems such as "emportant storage over development" and "emather importance on tradition than technology" in the archives management of colleges and universities. How to realize the in-depth mining and value release of archival resources with the help of information technology has become an important issue to be solved. Theoretical level: enrich the modern theoretical framework of college archives management and provide theoretical support for the construction of "smart archives". Practical level: By analyzing the transformation path and practical cases, it provides operational solutions for colleges and universities to optimize the file management process and improve service capabilities.

2. CURRENT SITUATION AND CHALLENGES OF UNIVERSITY ARCHIVES MANAGEMENT

University archives mainly include: teaching files: training plans, curriculum design, graduation papers, achievement data, etc.; scientific research files: project declarations, research reports, patent achievements, academic paper manuscripts, etc.; management files: administrative documents, personnel files, financial records, infrastructure drawings, etc.; characteristic

archives: school history cultural relics, alumni deeds, major activity records (such as school celebrations, international exchanges), etc.

It is characterized by: the formation of multiple subjects (teachers, students, management departments), diverse carrier forms (paper, electronic, multimedia), multi-layer value dimensions (administrative vouchers, academic reference, cultural inheritance).

Management mode: preliminary advancement of digital transformation

Most colleges and universities have established file management information systems to realize the digital scanning of paper files, electronic file metadata recording and basic retrieval functions. Some universities have tried to use the digital achievements of school history archives for campus cultural communication (such as online school history exhibition). For example, the Archives of Tsinghua University has built a "Digital School History Resource Library", which integrates school history photos, videos, manuscripts and other multimedia materials to provide support for school history research and cultural education.

Realistic challenges: the triple bottlenecks of technology, institutions and services

Technical level: insufficient digital depth

Resource integration fragmentation: the file systems of different departments (the Academic Affairs Office, the Scientific Research Office, the Academic Affairs Office) operate independently, the data format is not unified (such as PDF, XML, database files), and the lacks cross-system association retrieval ability; shallow technical application: only "archive digitization" (scanning storage), not achieve "digital archiving" (intelligent management based on big data and AI), such as automatic classification, semantic retrieval, risk warning and other functions are missing; long-term preservation risk: electronic files face outdated format (such as early database files), storage media aging (such as CDs, hard disk damage), meta-data loss and other problems, and the long-term readability guarantee mechanism is not perfect.

System level: the governance system needs to be optimized

The standard specifications are inconsistent: the lack of school-wide file metadata standards, classification rules and archiving processes, resulting in inconsistent the depth of the collection of different years and types of archives (for example, some "project achievements" fields in scientific research files contain patent numbers, and some only record the name of the results); lack of collaborative mechanism: the archiving cooperation between archives departments and business departments (such as departments and functional offices) relies on manual collection, the lack of automatic archiving trigger mechanism, archiving delay and omission problems are common; security and privacy risks: teacher and students' personal information (such as transcripts, medical records), scientific research sensitive data (such as undisclosed technical solutions) faces the risk of leakage in digital storage and sharing, and access rights control and data desensitization mechanisms need to be strengthened.

Service level: inaccurate demand response

Single way of use: users (teachers and students, alumni, researchers) mainly obtain files through offline applications or file system keyword retrieval, and lack of active push based on user needs (for example, graduates automatically receive student file transmission progress reminders, researchers obtain similar subject files related recommendations); insufficient cultural empowerment: the development of school history archives and characteristic archives stays at the level of "static display", and does not fully explore its cultural education value, such as failure to reproduce historical events through visual technology (VR, animation), failure to combine ideological and political education to create a "file education" brand project;

Service objects are limited: mainly for school users, the degree of openness to the public (such as middle school teachers and students, educational researchers) is low, and the social service function of archive resources is not fully released.

3. THE CORE PATH OF THE MODERNIZATION AND TRANSFORMATION OF ARCHIVES MANAGEMENT IN COLLEGES AND UNIVERSITIES: TECHNOLOGY EMPOWERMENT AND GOVERNANCE

INNOVATION

Front-end control: intelligent archiving and data governance. Develop a "one-stop archiving platform" to connect the OA system, the academic affairs system and the scientific research management system to realize the "formation and archiving" of electronic documents: when teachers submit course results and scientific researchers upload the project conclusion report, the system automatically captures the metadata (file type, formation time, responsible person) and triggers the archiving process to reduce manual operation errors. Apply OCR (optical character recognition) technology to digitize paper files in batches, and realize the automatic classification of text content in combination with NLP (natural language processing) (such as automatically classifying the "teaching evaluation report" into the "teaching file-evaluation materials" category) to reduce the cost of manual recording.

Mid-range storage: trusted and long-term storage adopts the "private cloud+local server" hybrid storage architecture, sensitive data (such as personnel files) are stored in the private cloud in the school, and public resources (such as school history pictures) are stored in the public cloud, taking into account security and accessibility convenience; introduce blockchain technology to build a "archive certificate chain" and hash-chain important electronic files (such as degree certificate electronic documents, scientific research acceptance reports) to ensure that the data cannot be tampered with and solve the problem of "legal effect of electronic archives"; establish an electronic file format migration mechanism, regularly convert outdated formats (such as early TIF pictures) into international common standard formats (such as PDF/A), and update metadata to ensure long-term readability. Back-end utilization: intelligent retrieval and knowledge discovery. Develop a "semantic search engine" to support natural language questions (such as "the list of project leaders of the National Natural Science Foundation of the National Natural Science Foundation of China since 2018"), and improve the search accuracy through keyword expansion (such as "National Natural Science Foundation" associated with "National Nature" and "NSFC"); build a "archive knowledge map" based on machine learning, sort out the relationship between archival entities (such as "teacher-course-s-scientific research projects - award-winning achievements"), and realize the intelligent recommendation of cross-category files (such as automatically push the scientific research project files he participates when viewing a teacher's teaching files).

System Restruction: Improving the Archives Governance System

Standardization construction: build a unified management standard for the whole school. Formulate the "University Archives Metadata Standard", clarify the core metadata fields (such as "document identifier", "formation institution", "custody period" and "secret level"), and ensure the consistency of the biography of different departments and different types of archives; promulgate the "Measures for the Management of Electronic Archives" to standardize the archiving scope, format requirements, approval process and division of responsibilities of electronic files, such as stipulating that "the final draft of scientific research papers should be archived with the PDF version and the original data file (such as experimental record Excel table) at the same time); establish a file quality evaluation mechanism, the filing time rate, complete rate and accuracy rate of each department into the school's annual assessment index, and the archiving responsibility of business department.

Collaborative governance: break down departmental barriers and build a "big file" pattern. Establish a "archive work committee" led by the leaders of the school in charge and with the participation of the archives department, the information management department, various departments and functional offices, and hold regular joint meetings to solve cross-departmental data sharing, system docking and other problems; establish a "file liaison system", each department/department designated a liaison officer to be responsible for the preliminary collation and pre-archiving of the unit's files, and the archives department provides business training and technical support to form a collaborative process of "grass-roots collection-professional audit-centralized management".

Security and privacy protection: hierarchical control and compliance management. Graded classification management: divide the files into three levels of "public", "internal" and "secret", open the public files (such as school history news) are open to the whole network for retrieval, internal files (such as undisclosed financial budgets) are limited to authorized users in the school, and confidential files (such as confidential scientific research project materials) need offline approval+physical isolation storage; data desensitization technology: files involving the privacy of teachers and students (such as transcripts, physical examination reports), automatically hide the ID number, home address and other sensitive information when providing use, and only retain the necessary fields (such as name, student number, score items); compliance review: connect the requirements of the Personal Information Protection Law and the Archives Law, regularly carry out file security audit, focus on checking the compliance of cross-border transmission of data (such as file sharing of international cooperation projects), third-party platform storage (such as data security

Service upgrade: from "passive provision" to "active empowerment"

Accurate service: meet multiple needs. Teacher and student service: Develop the "file self-service platform", support online application for transcript translation, academic degree certificate, scientific research achievement archiving certificate, etc., etc. the system automatically calls file data to generate standardized documents, realizes the onlineization of the whole process of "application-review-download", and the processing time is compressed from 3 working days to 1 hour; scientific research services: provide researchers with "topic-related file package" customized services, automatically extract relevant research project files, academic papers, patent achievements and similar research trends at home and abroad according to the keywords (such as "artificial intelligence+education"), and assist in scientific research topic selection and progress analysis; Alumni service: establish "alumni digital file space", alumni can log in to view personal results, awards, community activities records during school, and share to social platforms, and at the same time, the platform pushes school history dynamics and alumni activity notices to

Cultural education: build an archival culture brand. Normalization of school history education: develop school history archives into ideological and political education resources, such as selecting cases such as "school assistance in building border areas education" and "alumni participation in major national projects", making a series of micro-videos of "the original intention in the archives" and incorporating them into the content of freshman admission education and graduate party courses;

4. CONCLUSIONS AND PROSPECTS

Research conclusion: the modernization and transformation of archives management in colleges and universities is a systematic project of technological innovation, system optimization and service upgrading: technology is the foundation: solve the efficiency and storage problems of file management through the application of digitalization and intelligent technology in the whole life cycle; the system is the guarantee: the standardized and collaborative governance system is the key to break down departmental barriers and ensure data security; service is the core: the transformation from "archive custodian" to "knowledge service provider", so that archival resources can play the core value in educating people, scientific research and decision-making. Conclusion: the value of archival management in colleges and universities lies not only in preserving history, but also in activating history and empowering the future. Only by taking digital transformation as the engine and governance innovation as the driving force can archives become the "smart engine" and "cultural gene bank" for the high-quality development of colleges and universities.

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Cultural Shock and Coping Strategies of International Students in China——Taking Zibo Vocational Institute as an Example

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Abstract: This paper explores the cultural shock issues faced by Chinese teachers in the classroom when encountering international students at Zibo Vocational College, and proposes response measures. Through analysis of the manifestations and causes of cultural shock, and based on the college's actual situation, specific strategies are proposed from aspects such as enhancing teachers' cultural awareness, adjusting teaching methods, and promoting cross-cultural communication. These strategies aim to help international students better adapt to the classroom environment, improve their learning effectiveness, and enhance teachers' understanding and support for students from diverse cultural backgrounds.

Keywords: Zibo Vocational College; International Students; Cultural Shock; Response Measures

1. INTRODUCTION

With the acceleration of globalization, an increasing number of international students are choosing to study in China. Zibo Vocational College, as a vocational college with international influence, has attracted many international students. However, cultural differences may lead to cultural shock in the classroom, affecting students' learning effectiveness and participation. Therefore, it is of great practical significance to explore how teachers can respond to cultural shock and help students integrate into the classroom.

2. MANIFESTATIONS OF CULTURAL SHOCK FOR INTERNATIONAL STUDENTS AT ZIBO VOCATIONAL INSTITUTE

2.1 Teaching Philosophy and Method Differences

Zibo Vocational College emphasizes a teaching philosophy that combines theory with practice, focusing on students' practical and professional skills. However, international students from diverse cultural backgrounds may be more accustomed to their own country's teaching models. For example, some students may be more comfortable with traditional lecture-based teaching and find it difficult to adapt to the college's student-centered, inquiry-based, and group cooperative learning methods.

2.2 Language and Communication Barriers

Although international students have a certain foundation in Chinese, they may still be confused by professional terminology and complex expressions in specialized courses. Additionally, differences in language expression and cultural background may lead to misunderstandings or communication barriers in classroom interactions, affecting teacher-student interaction and student participation.

2.3 Classroom Participation Imbalance

Cultural factors can lead to some international students being more reserved in the classroom and less willing to speak up. In contrast, other students may be overly assertive due to their cultural encouragement of individual expression. This imbalance in classroom discussion can affect the overall learning atmosphere and effectiveness.

3. REFLECTIONS ON RESPONDING TO CULTURAL SHOCK BY TEACHERS AT ZIBO VOCATIONAL INSTITUTE

3.1 cultivating Cultural Awareness

Teachers should recognize the existence of cultural differences and view them as valuable teaching resources. They can participate in cultural training organized by the school and interact with international students to gain a deeper understanding of educational concepts,

learning habits, and values from different cultural backgrounds. For instance, Zibo Vocational College regularly invites foreign experts and cultural figures to campus for lectures, providing teachers with opportunities to engage with professionals from diverse backgrounds.

3.2 Flexible Adjustment of Teaching Methods

Teachers need to adjust their teaching methods flexibly according to the cultural backgrounds and learning characteristics of international students. For example, when teaching specialized courses, teachers can incorporate examples from students' home countries and use case analysis and comparative discussions to help them better understand key points. Additionally, increasing practical teaching sessions allows students to deepen their grasp of professional knowledge through hands-on experience.

3.3 Establishing Effective Communication Mechanisms

Teachers should create diverse communication channels to encourage international students to express their questions and ideas. They can have one-on-one conversations with students during breaks to understand their learning difficulties and needs, or set up online learning communities like WeChat groups for convenient Q&A sessions. Teachers should also enhance their cross-cultural communication skills, ensuring accurate language expression and cultural sensitivity.

4. SPECIFIC MEASURES FOR TEACHERS AT ZIBO VOCATIONAL COLLEGE TO RESPOND TO CULTURAL SHOCK PROVIDING CULTURAL ADAPTATION GUIDANCE

4.1 Cultural Adaptation Guidance

Organize a variety of cultural activities: Teachers regularly organize diverse cultural activities, such as cultural lectures, field trips, and international cultural festivals, allowing students to experience and feel the charm of Chinese culture firsthand. For example, invite cultural experts from both inside and outside the school to give lectures on traditional Chinese festivals, customs, art forms, etc., and organize visits to local museums, historical sites, and enterprises to provide students with a more intuitive understanding of China's social culture and development.

Provide cultural adaptation courses: Offer specialized courses on cultural adaptation that systematically introduce China's social culture, education system, laws, and regulations. These courses employ various teaching methods, including classroom lectures, group discussions, and case analyses, to enhance students' participation and learning outcomes.

Establish a cultural counseling mechanism: Create the position of cultural counselor, staffed by teachers with intercultural communication skills and cultural knowledge, to offer one-on-one cultural counseling to international students. These counselors regularly communicate with students to understand the problems they encounter during cultural adaptation and provide targeted advice and guidance.

Promote cultural exchanges among students: Encourage interaction and exchange among international students, Chinese students, and those from other countries through events like exchange meetings and association activities. This strengthens the understanding and friendship among students from diverse cultural backgrounds and fosters a multicultural learning environment. In addition, to deepen international students' understanding of Chinese culture, the college has developed a three-level cultural experience activity system that includes school culture, urban culture, and Chinese culture. This system offers international students comprehensive cultural experience opportunities by combining in-class and out-of-class activities, both on and off campus. For instance, schools introduce Chinese history and culture, including that of the Qi Lu region, in the classroom, and leverage Zibo's geographical advantages to organize visits to museums, historical sites, and local cultural events such as the Ceramics and Glass Expo and Zibo BBQ Festival. At the same time, guidance is provided to international students on coping with cultural shock, such as adjusting their mindset and building a support network.

4.2 Integrating Diverse Cultural Elements into Teaching Content

Incorporate multicultural cases: Teachers actively collect and integrate materials from

diverse cultural backgrounds into their teaching. For instance, in business courses, analyze commercial cultural differences between countries, such as comparing negotiation styles and marketing strategies between China and Arab nations; in art courses, appreciate works from various ethnicities and explore their cultural and artistic significance.

Conduct cross-cultural themed teaching: Design teaching units around specific cross-cultural themes to guide students in thinking from diverse cultural perspectives. For example, use "environmental protection" as a theme to help students understand different countries' environmental policies, measures, and cultural concepts, cultivating their global outlook and cross-cultural thinking skills.

Teach according to students' cultural background: Understand the cultural background and learning needs of international students, and adjust teaching content and methods based on their characteristics and interests. For example, incorporate elements of Islamic culture into teaching for Arab students, such as discussing the impact of Islam on business activities, to make teaching more relevant to their cultural background.

Promote internationalization of courses: Strengthen the internationalization of courses by developing a curriculum system with an international perspective and diverse cultural elements. Encourage teachers to collaborate with international scholars to write bilingual teaching materials and incorporate advanced international teaching concepts and methods. In recent years, the college has published more than ten bilingual textbooks, including Chinese Culture, Basic Chinese, Mechanical and Electrical Chinese, and Automotive Chinese, accelerating the process of internationalization.

4.3 Promoting Cross-Cultural Communication Activities

Hold cultural exchange activities for Chinese and foreign students: Regularly organize cultural exchange activities for Chinese and foreign students, such as cultural exhibitions, artistic performances, and sports competitions, to provide a platform for students to showcase their cultural characteristics and talents. For example, host a "World Culture Expo" where students from various countries display traditional clothing, handicrafts, food, etc., and conduct an "International Cultural Festival" with dance and music performances and cultural lectures to enhance students' understanding and appreciation of different cultures.

Establish international student associations: Support and guide international students in forming various associations, such as the International Students Union and Cultural Exchange Association, and encourage them to independently organize cross-cultural communication activities. These associations can regularly host language corners, cultural salons, film screenings, and other events to promote interaction and exchange among students.

Experience traditional Chinese festivals: the college organizes celebration activities for major traditional Chinese festivals, such as making zongzi during the Dragon Boat Festival, baking moon cakes during the Mid-Autumn Festival, and making dumplings during the Chinese New Year. These activities allow international students to personally experience traditional Chinese customs and gain a deeper understanding of the cultural significance and historical stories behind these festivals.

Experience campus activities and culture: When participating in campus activities, international students may feel unaccustomed due to unfamiliarity with activity rules and cultural connotations. For example, in campus cultural activities with Chinese characteristics, international students may need time to understand and adapt to relevant customs and activity formats.

Interaction with local residents: In daily interactions with local residents, international students may experience discomfort due to differences in customs and social etiquette. For instance, etiquette norms in social situations and communication styles in interpersonal relationships may differ from those in the students' home countries.

Teachers' participation in cross-cultural teaching research: Encourage teachers to actively engage in cross-cultural teaching research and practice, continuously exploring innovative teaching methods and strategies. Participating in academic seminars and

training courses related to cross-cultural teaching allows teachers to share experiences and insights with colleagues, collectively enhancing cross-cultural teaching standards.

4.4 Providing Targeted Learning Support

Develop bilingual teaching materials: Tailor teaching materials to the language proficiency and learning requirements of international students. These materials include bilingual textbooks, multimedia presentations, and exercise books to facilitate comprehension of course content. Additionally, leverage modern educational technology to create diverse learning resources, such as video lectures and online courses, offering international students enriched and flexible learning options.

Offer Language guidance and training: To boost the Chinese proficiency of international students, organize Language guidance classes or training programs. These programs provide tiered instruction based on students' language levels and incorporate extracurricular language practice activities, such as Chinese corners, speech contests, and writing competitions, to strengthen language application skills.

Set up a peer learning support system: Pair international students with Chinese students for collaborative learning. This arrangement enables international students to receive assistance and guidance from their Chinese peers, accelerating their adaptation to learning methods and requirements. Concurrently, Chinese students gain insights into different cultural perspectives from international students, fostering mutual growth.

Offer personalized learning guidance: Monitor each international student's learning progress and needs, providing individualized guidance. Teachers regularly engage in one-on-one conversations with students to identify learning challenges and develop customized plans and solutions, helping students overcome obstacles and enhance academic performance.

Adopt personalized coping measures: For Muslim students during Ramadan, the following measures can be taken:

- Flexible adjustment of course content and deadlines: Communicate with students to understand their needs and adjust the difficulty and pace of course content as needed. Avoid assigning overly burdensome homework and projects, and offer flexible deadlines for assignments.

Avoid scheduling important exams during Ramadan: Refrain from scheduling significant examinations or project submissions during Ramadan. If exams are unavoidable, notify students in advance to allow ample preparation time.

5. CONCLUSION

Cultural shock is a significant issue for international students at Zibo Vocational College. By enhancing teachers' cultural awareness, adjusting teaching methods, promoting cross-cultural communication, and providing targeted learning support, students can better overcome cultural shock, leading to improved learning outcomes and classroom participation. This process also contributes to the professional development of teachers and the internationalization of the college.

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Research on the Current Situation and Influencing Factors of Self-Efficacy in the Elderly—A Case Study of Zibo City

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Abstract: The current situation of self-efficacy among 233 elderly people in various communities of Zibo City was investigated, and the factors influencing their self-efficacy were analyzed. the results show that the self-efficacy of the elderly in Zibo City is at a moderately high level. Social support and interpersonal relationships are the main factors affecting the self-efficacy of the elderly. Although the self-efficacy of the elderly in Zibo City is at a moderately high level, the factors affecting self-efficacy still need to be considered, and multiple strategies should be adopted to continuously improve the self-efficacy of the elderly.

Keywords: Elderly people; Self-efficacy; Influence factor

1. INTRODUCTION

Self-efficacy refers to a person's belief in their ability to influence and control the environment. Self-efficacy plays a role in the degree of effort an individual exerts when choosing activities and participating in them, thereby influencing behavioral outcomes [1]. Individuals with high self-efficacy are more likely to deal with challenges with a positive mindset, while those with low self-efficacy may experience negative emotions. the results of China's seventh national census show that the population aged 60 and above in Zibo City has reached 1.0932 million, accounting for 23.24% of the city's total population. the population aged 65 and above is 776, 000, accounting for 16.49% of the city's total population. the aging level is higher than the national and provincial averages, and the aging situation is severe. the Self-efficacy theory was proposed by Bandura. He believes that self-efficacy refers to a person's belief in their ability to influence and control the environment. It does not arise out of thin air but is based on certain experiences or information. It is the subject's self-judgment of the effect of an individual's interaction with the environment. Self-efficacy plays a role in the degree of effort an individual exerts when choosing activities and participating in them, thereby influencing behavioral outcomes. Self-efficacy is closely related to an individual's stress state, anxiety, depression and other emotional responses. Individuals with high self-efficacy are more likely to deal with challenges with a positive mindset, while those with low self-efficacy may experience negative emotions. the theory of self-efficacy has been widely applied in multiple fields such as education, enterprise management, and psychological counseling. This study aims to explore the current situation of self-efficacy among the elderly in Zibo City and its influencing factors, providing a theoretical basis for formulating measures to improve the self-efficacy of the elderly in the community.

2. RESEARCH OBJECT AND METHODS

2.1 Research object

From November 2023 to January 2024, a convenient sampling method was adopted to select 233 elderly residents from various communities in Zibo City as the research subjects. Inclusion criteria:①Age≥60 years old; ②No mental abnormalities, capable of normal communication; ③Proficient in using mobile phones to fill out questionnaires or willing to have the survey team assist in completing the questionnaire; ④Voluntarily participate in this survey. Exclusion criteria: Elderly individuals with mental disorders, significant physical illnesses, or cognitive impairments.

2.2 Research tool

2.2.1 General Information Survey

Questionnaire Designed by the researcher, the questionnaire items include: gender, age, occupation type, family residence, education level, marital status, family income level, physical health status, social support, and interpersonal relationships.

2.2.2 The General Self-Efficacy Scale is used to assess the general self-efficacy of the elderly. the GSES scale was developed by Schwarzer et al. the scale used in this study is the Chinese version translated and revised by Wang Caikang et al. It consists of 10 questions. This scale adopts the Likert4 scoring method. Each question is scored between "1= completely incorrect" and "4= completely correct". the total score range is set between 10 and 40 points, while the international common standard or norm score is 28.6 points [2]. According to this criterion, the specific level of self-efficacy is subdivided as follows: between 10 and 20 points, which is considered a low level; A score between 21 and 30 indicates a medium level. If the score reaches between 31 and 40 points, it indicates that the self-efficacy is at a high level. the higher the score, the higher the general level of self-efficacy of the elderly. In this study, the internal consistency coefficient of this scale was 0.918.

3. RESULT

3.1 General Information of the Research Object

In this study, there were 93 males, accounting for 39.91%, and 140 females, accounting for 60.09%. the group of 60-69 years old has the largest number of elderly people, with 143 people. 77.25% of the elderly people live in urban areas, 67.81% of the elderly people have a college degree or above, 70.39% of the elderly people are working in state organs and institutions, 222 married elderly people, 65.24% of the elderly people have a monthly household income of more than 6, 000 yuan, 46.78% of the elderly people have good health status, 55.36% of the elderly people have good social support, and 56.65% of the elderly people have good interpersonal relationships.

3.2 The basic situation of self-efficacy among the elderly

The score of self-efficacy of the elderly was (28.79±5.79) points. See Table 1 for details.

Table 1. Basic Situation of Elderly People's Sense of Meaning in Life (n=233)

Min	Max	M	SD
10	40	28.79	5.79

3.3 Comparison of self-efficacy scores among elderly people with different characteristics

Taking the general sociodemographic characteristics of the elderly in Zibo City as the independent variable and the self-efficacy of the elderly as the dependent variable, one-way analysis of variance or independent sample t-test was conducted. the research results show that there are differences in the influence of social support and interpersonal relationships on the sense of meaning in life of the elderly, and the differences are statistically significant ($P<0.05$). In terms of other factors, the difference was not statistically significant.

4. DISSCUSSION

The research results show that the self-efficacy score of the elderly in Zibo City is (28.79±5.79) points, which is at a moderately high level and higher than the international norm of 28.6 points. Through long-term accumulation of life experience, continuous learning and participation in social activities, the elderly have developed a strong sense of self-efficacy, they believe they can cope with various challenges in life, including health management, social interaction and adaptation to changes in the social environment. This positive self-awareness not only improves their quality of life, but also promotes physical and mental well-being. With the improvement of social and economic conditions and the enhancement of medical standards, some elderly people can maintain good physical health, actively participate in social activities, and have a relatively high sense of self-efficacy. These elderly people usually have a relatively rich social support network, from which they can obtain emotional comfort and practical assistance, thereby further enhancing their sense of self-efficacy. Zibo City has taken a series of positive measures to address the challenges of an aging population, such as strengthening the construction of community elderly care service facilities and promoting smart elderly care service models. These measures are expected to enhance the self-efficacy of the elderly to a certain extent. By optimizing the supply of elderly care services

and enhancing the social participation and sense of belonging of the elderly, it can effectively alleviate the psychological pressure brought about by their aging and promote the improvement of their self-efficacy. Elderly people with high self-efficacy, tend to be more convinced that they can influence and change their lives, This positive self-awareness prompts them to explore the meaning of life more actively, and thus find more sense of value and satisfaction in their later years. Individuals with high self-efficacy tend to adopt a positive attribution approach when facing difficulties, viewing challenges as opportunities for growth rather than threats, thereby maintaining an optimistic attitude and stable emotions. This positive psychological state helps individuals better cope with the stress and uncertainty in life. On the contrary, older people with lower self-efficacy may have a negative attitude towards life, lack motivation to explore the meaning of life, and result in a relatively weaker sense of meaning in life. Older adults with a strong sense of self-efficacy are more likely to view challenges in life as opportunities for growth and self-actualization, they tend to interpret life events from a positive perspective, and thus find meaning and purpose in life more easily. This positive mental state not only helps them cope with difficulties in life, but also improves their overall life satisfaction and well-being. Therefore, In the promotion and intervention of mental health in old age, is crucial to attach importance to and enhance the self-efficacy of the elderly. By enhancing their self-efficacy, can help older people face life more positively, explore and find the meaning and value of life, thereby achieve higher levels of mental health and quality of life.

5. CONCLUSION

This study investigated the influencing factors and current situation of self-efficacy among the elderly in Zibo City. the results show that the self-efficacy score of the elderly in Zibo City is at a moderately high level, and social support and interpersonal relationships have an impact on the self-efficacy of the elderly. Governments at all levels and their relevant departments should formulate policies and take multiple measures to continuously enhance the self-efficacy of the elderly.

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Enhancing Learner Engagement in MOOCs through Aspect-Based Sentiment Analysis: A Comprehensive Review and Framework

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Abstract: Massive Open Online Courses (MOOCs) have revolutionized access to education, offering diverse learning opportunities to a global audience. However, the vast and heterogeneous nature of learner feedback presents significant challenges in understanding and enhancing learner engagement. Aspect-Based Sentiment Analysis (ABSA) emerges as a potent tool to dissect nuanced opinions within this feedback, enabling targeted improvements in course design and delivery. This paper explores the application of ABSA in MOOCs, reviewing existing literature, identifying challenges, and proposing a comprehensive framework to harness ABSA for enhancing learner engagement. Through a case study on a popular MOOC platform, we validate the proposed framework, demonstrating its potential to improve course completion rates and learner satisfaction. Future directions for research and development are also discussed.
Keywords: Aspect-Based Sentiment Analysis, MOOCs, Deep Learning, Feedback Analysis

1. INTRODUCTION

Massive Open Online Courses (MOOCs) have become an integral part of modern education, providing a flexible, scalable, and accessible alternative to traditional classroom-based learning. With platforms such as Coursera, edX, and Udemy attracting millions of learners globally, MOOCs cater to a diverse audience, ranging from high school students seeking supplementary education to professionals pursuing career advancement. These platforms have democratized education by removing barriers such as geographical limitations and high costs, thereby enabling lifelong learning.

Despite their transformative potential, MOOCs face significant challenges in maintaining learner engagement and achieving high completion rates. Research indicates that the average completion rate for MOOCs is below 10%, with many learners disengaging midway through their courses. the reasons for this disengagement are multifaceted, ranging from course design and instructor performance to platform usability and peer interaction. Understanding these factors is critical for improving the overall learning experience and increasing retention rates.

Learner feedback, often provided in the form of course reviews, discussion forum posts, and survey responses, offers valuable insights into these issues. However, analyzing this feedback is challenging due to its unstructured nature, high volume, and linguistic diversity. Traditional sentiment analysis, which classifies feedback as positive, negative, or neutral, fails to capture the nuances of learner experiences. For instance, a learner might express satisfaction with the course content but dissatisfaction with the instructor's teaching style. Such granular insights are essential for targeted improvements.

Aspect-Based Sentiment Analysis (ABSA) addresses this limitation by enabling the identification of specific aspects of a service or product and analyzing the sentiments associated with them. In the context of MOOCs, ABSA can provide actionable insights into various aspects of the learning experience, such as course content, instructor effectiveness, platform usability, and peer interaction. This paper explores the application of ABSA in MOOCs, reviewing existing literature, identifying challenges, and proposing a robust framework tailored to the unique requirements of MOOC environments.

2. LITERATURE REVIEW

2.1 Aspect-Based Sentiment Analysis in Other Domains

Aspect-Based Sentiment Analysis has been extensively studied and applied across various domains, including e-commerce, healthcare, and hospitality. In the e-commerce sector, ABSA has been used to analyze customer reviews to identify sentiments associated with specific product features such as quality, price, and delivery time. For instance, a study by Zhang et al. demonstrated how ABSA could help e-commerce platforms prioritize feature improvements based on customer feedback. Similarly, in healthcare, ABSA has been employed to analyze patient reviews to uncover sentiments about aspects such as staff behavior, wait times, and medical facilities, thereby helping healthcare providers improve service quality.

In the hospitality industry, ABSA has been instrumental in analyzing online reviews on platforms like TripAdvisor and Booking. com. By identifying sentiments related to specific aspects such as cleanliness, location, and customer service, hotel managers can make targeted improvements to enhance guest satisfaction. These applications highlight ABSA's versatility and effectiveness in extracting actionable insights from unstructured text data.

2.2 ABSA in Education

In the educational domain, the application of ABSA is still emerging but shows great promise. Hajrizi and Nuçi [1] explored the use of ABSA in understanding student feedback in traditional classroom settings. Their study highlighted the potential of ABSA to identify specific pain points in the learning process, such as unclear instructions or inadequate resources. Bhowmik et al. [2] extended this application to teacher evaluations, demonstrating how ABSA could provide granular insights into teaching effectiveness based on student feedback.

However, these studies primarily focus on traditional educational settings and do not fully address the unique challenges of online learning environments. For instance, the global and asynchronous nature of MOOCs introduces complexities such as linguistic diversity and cultural differences, which require specialized analytical approaches.

2.3 ABSA in MOOCs

The application of ABSA in MOOCs is relatively nascent, with only a few studies addressing this area. Kastrati et al. [3] proposed the MASC-MEF framework, a systematic approach to applying ABSA in MOOCs. This framework incorporates key steps such as data preprocessing, aspect extraction, and sentiment classification, providing a foundation for further research. However, the framework does not fully address the challenges posed by the dynamic and multilingual nature of MOOCs. Building on this work, our study aims to develop a comprehensive framework that overcomes these limitations and leverages ABSA to enhance learner engagement in MOOCs.

3. METHODOLOGY

Our proposed methodology consists of five key phases, each designed to address the specific challenges of applying ABSA in MOOCs.

3.1 Data Collection

The first step involves collecting learner feedback from multiple sources, including:

Course Reviews: Learner ratings and comments on course pages.

Discussion Forums: Threads where learners discuss their experiences and challenges.

Social media: Posts and comments on platforms such as Twitter and Reddit.

To ensure data diversity, we collect feedback from courses across various disciplines and skill levels. This diversity helps in capturing a comprehensive understanding of learner experiences.

3.2 Data Preprocessing

Learner feedback data is often noisy and unstructured, necessitating preprocessing steps such as:

Text Normalization: Correcting spelling errors, standardizing abbreviations, and expanding contractions.

Language Detection and Translation: Identifying the language of each feedback entry and translating non-English text into a common language, such as English.

Stopword Removal: Eliminating common words that do not contribute to sentiment analysis, such as "the" and "and. "

3.3 Aspect Extraction

Aspect extraction involves identifying specific elements of the learning experience

mentioned in the feedback. We employ a hybrid approach that combines rule-based methods with machine learning models. Rule-based methods use predefined dictionaries of keywords, while machine learning models, such as Conditional Random Fields (CRF) and BERT-based models, are trained on labeled datasets to identify aspects dynamically.

3.4 Sentiment Classification

Sentiment classification assigns a sentiment label (positive, negative, or neutral) to each identified aspect. We use transformer-based models, such as BERT and its multilingual variants, for this task. These models are fine-tuned on domain-specific datasets to improve their accuracy in handling nuanced and context-dependent sentiments.

3.5 Analysis and Visualization

The final phase involves analyzing the extracted aspects and their associated sentiments to identify trends and areas for improvement. Visualizations, such as sentiment heatmaps and aspect-wise satisfaction scores, are generated to provide actionable insights to educators and course designers.

4. CHALLENGES IN APPLYING ABSA TO MOOCS

The application of Aspect-Based Sentiment Analysis (ABSA) in MOOCs comes with challenges arising from the diverse and dynamic nature of these platforms. Addressing these issues is critical to extracting accurate and actionable insights from learner feedback.

4.1 Data Imbalance

Feedback in MOOCs is often dominated by certain aspects, such as course content, while others, like peer interaction, receive less attention. This imbalance can skew analysis, with dominant aspects overshadowing less-discussed but equally important issues. For instance, courses with excellent content but limited opportunities for peer collaboration may still receive overwhelmingly positive feedback, hiding areas that need urgent improvement.

4.2 Multilingual and Cultural Diversity

MOOCs draw a global audience, leading to multilingual and culturally diverse feedback. Learners express opinions in different languages, dialects, or even mixed-language responses (code-switching), while cultural differences affect how sentiments are conveyed. For example, a phrase expressing mild dissatisfaction in one culture might be perceived as highly negative in another, complicating sentiment interpretation.

4.3 Implicit Sentiments

Learners often express implicit sentiments subtly, requiring contextual understanding. For example, "I had to rewatch the video multiple times" implies unclear explanations. Informal language, abbreviations, and emojis in feedback further challenge sentiment detection.

4.4 Dynamic Content

MOOCs evolve continuously, with updates to course content, platforms, and instructional methods. Static ABSA models trained on outdated data may fail to adapt, leading to inaccurate analyses. Models must account for these changes to remain effective and reliable.

5. CASE STUDY: APPLICATION OF ABSA IN MOOC PLATFORM

5.1 Experiment Design

To validate the proposed ABSA framework, a case study was conducted on a popular MOOC platform. the dataset consisted of 10, 000 learner feedback entries collected from courses in technology, business, and humanities. These feedback entries covered multiple aspects of the learning experience, such as course content, instructional quality, platform functionality, and learner interaction. To ensure the quality of analysis, the raw data underwent detailed preprocessing, including text cleaning, language normalization, and stopword removal. the proposed ABSA framework was then applied to extract specific aspects of the learning experience and their associated sentiments.

5.2 Results

The analysis revealed key aspects of learner feedback and their sentiment distributions, including:

 Positive Aspects: Learners expressed high satisfaction with the clarity and organization of course content, the expertise of instructors, and the logical structure of the courses. These findings indicate that course designers performed well in content planning and instructor selection.

 Negative Aspects: the main complaints

from learners focused on two areas:
1. Technical Issues: Some learners reported issues with video loading, page navigation, and mobile compatibility, which negatively impacted their overall learning experience.
2. Lack of Learner Interaction: Many learners noted a lack of opportunities to interact with peers, which led to feelings of isolation, especially when discussing complex topics or completing group projects.
These findings not only highlighted the strengths and weaknesses of the learning experience but also provided clear directions for potential improvements.

5.3 Impact

While the analysis provided valuable insights for course designers and platform operators, resource constraints and technological limitations prevented the platform from implementing large-scale improvement initiatives immediately. the following summarizes the actual impact of the analysis and potential follow-up actions:
1. Short-Term Adjustments:
2. The platform implemented minor optimizations in response to the analysis findings. For instance, regarding technical issues, the platform team prioritized fixing frequent navigation errors and improving video loading speeds. These changes were relatively easy to implement, required minimal resources, and had a short execution timeline.
3. Limited Enhancements to Learner Interaction:
4. To address the lack of peer interaction, the platform introduced a topic recommendation algorithm in its discussion forums to encourage learners to participate in discussions related to course topics. This improvement utilized existing technical modules without introducing additional features like real-time chat or team collaboration tools.
5. Long-Term Planning:
6. More complex improvements, such as a comprehensive peer mentoring program or a large-scale UI/UX redesign, were included in the platform's long-term planning. These initiatives require additional budget, technical resources, and further analysis of learner behavior data, making them infeasible to implement immediately.
7. Data-Driven Follow-Up Research:
8. The platform's course design and operations teams used the analysis findings as a foundation for further research. For instance, they explored additional feedback from similar courses to validate the generalizability of the identified issues. If similar navigation issues were reported across multiple technical courses, the platform could prioritize systematic enhancements to the user experience in those courses.
In practice, while the analysis highlighted potential areas for improvement, resource limitations and operational priorities restricted the platform's ability to carry out large-scale changes. Nevertheless, the insights generated through ABSA improved the platform's decision-making process, making it more targeted and evidence-based, and provided a foundation for future iterative optimizations.

6. CONCLUSION

Aspect-Based Sentiment Analysis (ABSA) offers a powerful tool for analyzing learner feedback in MOOCs, providing granular insights into various aspects of the learning experience. By addressing the unique challenges of MOOCs, such as linguistic diversity and dynamic content, the proposed framework enables educators and course designers to enhance learner engagement and satisfaction. Future research should focus on developing more robust and adaptive ABSA models to further improve the scalability and applicability of this approach.

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Practical Exploration of Student Club Construction Under the Guidance of Party Building Brand

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Abstract: College student clubs are important carriers for implementing the fundamental task of cultivating students' moral character and cultivating their comprehensive qualities. This article takes the construction of party building brands as the starting point, analyzes the problems existing in the current construction of student clubs, explores the practical path of optimizing the educational function of clubs through the guidance of party building brands, and proposes the construction of a "party building+club" collaborative development model. Through strategies such as ideological guidance, organizational construction, brand cultivation, and resource integration, it promotes the greater role of student clubs in ideological and political education, campus culture construction, and student growth and development, providing theoretical and practical references for the coordinated development of grassroots party building and student clubs in universities.

Keywords: Party building brand; Student organizations; Collaborative education; Practical exploration

1. INTRODUCTION

As an important component of the second classroom in colleges and universities, student associations serve as a significant platform for uniting young people and facilitating their growth. However, some student associations in current universities are facing issues such as insufficient ideological guidance, lack of organizational vitality, and inadequate fulfillment of their educational functions. Integrating the construction of Party organizations with the development of student associations, taking the construction of Party brands as a key approach, and establishing a working pattern of "Party leadership, brand empowerment, and collaborative education" have become the key paths to enhancing the quality of student association construction.

2. THE IMPORTANCE OF PARTY BUILDING BRANDS LEADING THE CONSTRUCTION OF STUDENT CLUBS

2.1 Strengthen the "navigator" guided by ideology

College student clubs are an important field for the formation of values among young students. Through the construction of party building brands, integrating Xi Jinping's Thought on Socialism with Chinese Characteristics for a New Era, Red Culture, and Socialist Core Values into club activities can guide students to firmly establish their ideals and beliefs, build a solid ideological foundation, and solve the fundamental problem of "what kind of people to cultivate, how to cultivate people, and for whom to cultivate people" in clubs.

2.2. The "engine" that stimulates organizational vitality

The construction of party building brand requires the improvement of the organizational structure of the club party, the establishment of a mechanism of "club branch party member vanguard post red backbone training", the activation of the effectiveness of the club organization through the exemplary role of party members, the resolution of problems such as loose management and homogenization of activities, and the enhancement of the cohesion and attractiveness of the club.

2.3 Incubator for Innovative Education Vehicles

Building characteristic club projects based on party building brands, such as red theory

lectures, volunteer services, social practices, etc., can combine ideological education with practical education, enrich the connotation of club activities, form a "one brand, one characteristic" education matrix, and meet the diverse development needs of students.

3. THE PROBLEMS IN THE CURRENT CONSTRUCTION OF STUDENT CLUB

3.1. The leading role of party building is not fully utilized

There is a phenomenon of "emphasizing activities over ideas" in the management of some university clubs, and the guidance of party organizations to clubs remains at the formal level, without forming a normalized mechanism for ideological guidance; the proportion of party members in the club is relatively low, and the role of pioneers and models is not prominent, leading to a weakening of the political attributes and educational functions of the club.

3.2. Serious homogenization in brand building

Many club activities are limited to cultural and entertainment activities, lacking deep integration with party building work and professional characteristics. Brand projects lack innovation and are difficult to form long-term influence; Some clubs rely on external resources to drive their development, with weak endogenous driving forces and a phenomenon of "flash in the pan".

3.3 The collaborative education mechanism is not perfect

The coordination and linkage between the school party committee, youth league committee, secondary colleges, and clubs are insufficient, and the efficiency of resource integration is low; the inadequate training system for the backbone of the club and the lack of a progressive training path from "ordinary members active members student party members" have constrained the sustainable development of the club.

4. THE PRACTICE PATH OF PARTY BUILDING BRAND LEADING THE CONSTRUCTION OF STUDENT CLUBS

4.1 Building an organizational system of "Party building+clubs" to solidify the foundation of brand building

4.1.1 Strengthen organizational coverage. Establish "functional youth league branches" or "party member vanguard groups" in clubs, promote the establishment of party groups in eligible clubs, and achieve the goal of "branches built on clubs"; Select outstanding party member teachers to serve as guidance teachers for clubs, and strengthen the political leadership of party organizations over clubs.

4.1.2 Improve the training mechanism. Implement the 'Youth and Horse Club Backbone Plan', including club leaders as key training targets for school party member development, and enhance their political literacy through 'theoretical learning+practical training'; Carry out the "Party Member Demonstration Post" creation activity, guide Party members to highlight their identities and set benchmarks in club activities.

4.2 Build a "red+distinctive" brand project to enhance the effectiveness of education

4.2.1. Deeply cultivate red cultural brands. Relying on local red resources, we will create clubs such as the "Red Theory Propaganda Team" and the "Party History Scene Drama Society". Through immersive activities such as "Revisiting the Long March Road" and "Red Story Sharing Meetings", we will transform the study and education of Party history into vivid club practices. For example, the "Spark Propaganda Team" of a certain university has conducted more than 100 party history lectures, covering more than 20000 teachers and students, forming the "Walking Ideological and Political Classroom" brand.

4.2.2 Integrate professional characteristics and innovate. Promote the construction of "Party building+professional" clubs, such as the "Party Member Science and Technology Innovation Pioneer Team" and the "Rural Revitalization Practice Team", combining professional learning with serving society. For example, the Architectural Society of the School of Architecture organized students to survey revolutionary sites and design red cultural walls with the theme of "Red Architecture Research", which not only enhances professional skills but also cultivates patriotism.

4.2.3 Use new media to expand the position: build an "online party building+community" platform to spread red culture and show the style of the community through short videos, live broadcasts, official account and other

forms. For example, the "100 Years of Party History and 100 Episodes of Animation" produced by the "Red Micro Course Creation Society" has received over 100000 views on campus media, forming a "red classroom at your fingertips".

4.3 Establish a sound "collaborative+long-term" guarantee mechanism to stimulate brand vitality

4.3.1 Build a multi-party collaborative system. Establish a "four in one" working mechanism of unified leadership by the school party committee, overall coordination by the youth league committee, specific guidance by the party committees of secondary colleges, and autonomous management of clubs. Regularly convene joint meetings for party building and club construction, integrate teaching, student work, scientific research and other resources, and provide financial, venue, mentor and other support for brand projects.

4.3.2 Improve the evaluation and incentive mechanism. Incorporate party building elements into the assessment indicators of clubs, establish a selection system for "star rated red clubs" and "excellent party building brand projects", and commend outstanding clubs and individuals; Incorporate club activities into the comprehensive quality evaluation system for students, and motivate them to actively participate and deeply practice in brand building.

4.3.3 Establish a mechanism for transforming achievements. Promote the integration of club brand projects with social practice, volunteer service, and innovation and entrepreneurship, forming a closed loop of "project cultivation practice implementation achievement transformation". For example, the "Assisting Agriculture Live Streaming Club" has transformed rural revitalization practices into innovative and entrepreneurial projects, won national level competition awards, and achieved a dual enhancement of educational value and social value.

5. PRACTICAL CASE: BRAND BUILDING OF THE "RED CANDLE LEADING" ASSOCIATION IN A CERTAIN UNIVERSITY

A certain university has taken "Red Candle Leading" as its Party building brand, leading to remarkable achievements in student association construction:

5.1. Organizational Structure. Functional Youth League branches have been established in 32 student associations, and 20 Party member teachers have been selected as "Red Candle Mentors", achieving a 100% coverage rate of Party organizations in associations.

5.2. Brand Projects. Three sub-brands have been created: "Red Candle Lecture Hall" (theoretical propaganda), "Red Candle Action" (community service), and "Red Candle Maker" (science and technology innovation competition), with over 200 activities held annually, involving more than 5, 000 students.

5.3. Educational Outcomes. In the past three years, the proportion of active applicants for Party membership among association members has increased by 35%, and five associations have been awarded the title of "Outstanding Association" at the provincial level or above. Relevant experiences have been reported on the official website of the Ministry of Education.

6. CONCLUSION

Leading the construction of student clubs with the brand of Party building is an important measure to implement the fundamental task of cultivating morality and talents in universities. In the future, it is necessary to further deepen the concept of "Party building+", promote the deep integration of Party building work and the development of clubs in terms of goals, resources, and mechanisms, and form a benign ecology of "Party flag leading, brand gathering, and youth growth", contributing to the cultivation of new era talents who shoulder the great responsibility of national rejuvenation.

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Research on Empowering College Students' Mental Health Education with Artificial Intelligence

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Abstract: As a product of the new era, artificial intelligence has been widely applied in many fields. Therefore, it is particularly necessary to introduce it into the field of education. the importance of mental health education for college students is becoming increasingly prominent, and it is particularly important to introduce artificial intelligence technology in line with the trend of the times. However, from the current situation of artificial intelligence empowerment, there are still many problems that have led to the insufficient value of artificial intelligence in the field of education. Therefore, how to seize the opportunities brought by artificial intelligence, better integrate it into mental health education, and improve the effectiveness of mental health education is something that relevant educators should attach great importance to. This article explores the importance of empowering college students' mental health education with artificial intelligence, points out the challenges faced by empowering college students' mental health education with artificial intelligence, and proposes a path for empowering college students' mental health education with artificial intelligence.

Keywords: Artificial intelligence; Universities; College student; Mental health education

1. INTRODUCTION

In recent years, the development speed of artificial intelligence has been accelerating, and its role in the field of education has become increasingly prominent. College students in the new era are exposed to various new things from a young age and are accustomed to using online platforms to obtain information. the quality of information on the platforms varies greatly, and college students with weak critical thinking abilities are easily affected, leading to frequent mental health problems. Many universities have increased their emphasis on mental health education for college students, but there are still many problems in previous teaching, such as lack of resources and insufficient targeting. the application of artificial intelligence technology can effectively alleviate the problem of mental health education, break through the limitations of traditional space, better meet the personalized needs of students, and effectively improve the mental health level of college students. Therefore, mental health education workers in universities need to actively understand artificial intelligence technology, deeply explore the mental health issues of college students, explore practical and feasible paths for integrating artificial intelligence technology, and promote the continuous improvement of the quality of mental health education.

2. THE IMPORTANCE OF ARTIFICIAL INTELLIGENCE EMPOWERING PSYCHOLOGICAL HEALTH EDUCATION FOR COLLEGE STUDENTS

2.1 Promoting the Improvement Of Psychological Conditions Among College Students

Factors such as family environment, social relationships, and academic pressure can all have an impact on the mental health of college students. In the new era, college students often experience various negative emotions such as anxiety and depression, which hinder their healthy growth. In the era of artificial intelligence, there are increasingly more factors that can cause mental health problems among college students. Universities need to combine the actual situation of students, carry

out targeted mental health education activities on the basis of protecting personal privacy, guide students to improve their ability to withstand pressure, establish correct values, cultivate good psychological qualities, and be able to flexibly respond to various problems, so as to achieve better development.

2.2 Promote Innovation In the Mental Health Education System

After entering the era of artificial intelligence, continuing to use traditional mental health education models is obviously unable to provide effective assistance to students, and innovative mental health education models are imperative. Fully utilize artificial intelligence technology, optimize the mental health education system, enrich the content of mental health education, extend education from offline to online, and enhance the pertinence of mental health education activities. [1] In this situation, it can effectively stimulate students' motivation to participate in mental health activities, ensure the quality of mental health education, and lay a foundation for students' healthy growth.

2.3 Meet Students' Personalized Consultation And Tutoring Needs

The application of artificial intelligence technology can better meet the personalized needs of students and provide them with good psychological counseling services. By utilizing data analysis and other technologies, we can provide students with practical psychological health education content that meets their actual needs, better meeting their personalized service needs and improving the quality of psychological health education. With the help of artificial intelligence technology, students' social and online behaviors can be effectively analyzed. By monitoring student data in real time, psychological health problems can be detected in a timely manner, and early intervention and elimination of psychological problems can be carried out to avoid further expansion of the problem.

3 CHALLENGES FACED BY COLLEGE STUDENTS' MENTAL HEALTH EDUCATION EMPOWERED BY ARTIFICIAL INTELLIGENCE

3.1 Data Security And Privacy Protection

The importance of mental health education for college students is self-evident, and the introduction of artificial intelligence technology can better meet the personalized service needs of students. However, the use of artificial intelligence may have certain security issues, such as hacker attacks, which can affect the security of data. This not only makes it difficult to achieve the goals of mental health education, but also weakens students' trust in mental health education. Psychological health data may involve sensitive information such as psychological assessment results, and if the data is leaked, it can easily have a negative impact on students' reputation. In order to effectively solve the existing problems, encryption technology needs to be applied to ensure the security of data transmission, and system protection work should be done well. Vulnerabilities should be scanned regularly, and strict access regulations should be implemented to allow authorized personnel to access and use relevant data. Schools also need to do a good job in privacy education to ensure that students enhance their awareness of privacy protection, so that artificial intelligence can effectively benefit students.

3.2 Technology Still Needs Further Optimization

The psychological data obtained by artificial intelligence cannot guarantee accuracy, and students' psychological states are constantly changing. In addition, the authenticity of the information provided due to privacy concerns is still debatable, resulting in biased results based on data analysis. At the same time, psychological problems often involve human emotions, and artificial intelligence has obvious deficiencies in understanding emotions. [2] Existing technology cannot capture and interpret complex human emotions, which can easily lead to misinterpretation problems. Individual differences among college students certainly exist, and artificial intelligence is difficult to dynamically adjust based on their actual situation, making it difficult to meet personalized tutoring needs to a higher degree. In addition, the accuracy of artificial intelligence algorithms needs to be further improved. the black box nature can easily reduce the effectiveness of decision-making, leading to doubts among teachers and students

about the results and weakening their willingness to use artificial intelligence.

3.3 There Is a Relatively Large Shortage Of Professional Talents

To fully utilize the role of artificial intelligence in college students' mental health education, professional talents as a supporting force are essential. Nowadays, there is a huge shortage of high-quality talents who possess knowledge of mental health education and artificial intelligence technology. Psychological health education requires good observation skills, logical thinking ability, and solid professional foundation, while artificial intelligence needs to master complex technologies such as data processing. There is a serious shortage of talents who can cleverly integrate artificial intelligence in psychological health education. In this situation, it is particularly difficult to fully utilize the value of artificial intelligence. At the same time, existing mental health educators have insufficient understanding of artificial intelligence tools and weak application capabilities, while technical personnel have insufficient knowledge of mental health education, which cannot guarantee that the introduction of artificial intelligence in mental health education can achieve the desired effect. In addition, universities have not yet closely integrated artificial intelligence and mental health education in talent cultivation, resulting in a growing talent gap in related fields that does not match the ever-changing educational needs. Therefore, it is urgent to adjust the curriculum system and strengthen the cultivation of interdisciplinary talents in the future.

4 THE PATH OF EMPOWERING COLLEGE STUDENTS' MENTAL HEALTH EDUCATION WITH ARTIFICIAL INTELLIGENCE

4.1 Application Of Artificial Intelligence In Mental Health Monitoring

To ensure more significant results in mental health education for college students, it is necessary to actively introduce artificial intelligence technology to develop scientific education plans and effectively monitor students' psychological states. Therefore, it is necessary to construct a psychological health assessment model, regularly organize psychological assessment activities, use computer algorithms to monitor students' psychological dynamics, accurately identify students' psychological problems, and provide effective support for improving students' psychological health level.

Nowadays, with the support of artificial intelligence technology, there are increasingly diverse methods for collecting psychological data from students, which can effectively integrate various types of data and better identify students' psychological problems. Therefore, the mental health assessment model can accurately evaluate the mental health level of students, collect relevant data through intelligent systems, generate mental health reports based on continuous assessments, and clarify students' psychological conditions. Currently, many schools are actively developing mental health systems aimed at gaining a deep understanding of students' psychological conditions and providing scientific psychological guidance for them.

4.2 Application Of Artificial Intelligence In Mental Health Services

Artificial intelligence technology can develop psychological counseling modules and virtual psychological teachers, providing personalized solutions for students and guiding them to self alleviate the negative impact of negative emotions. [3] Firstly, the use of artificial intelligence image synthesis technology can shape virtual teachers, provide psychological counseling and other services for students, achieve real-time interaction between virtual teachers and students, and ensure that students receive timely psychological guidance services; Secondly, natural language understanding algorithms can extract important information from user input language and recognize user emotions, while dialogue management algorithms can display real-time dialogue situations. Semantic understanding algorithms can clarify the hidden meanings of dialogues and output more targeted information; Furthermore, machine learning algorithms can accurately identify students' psychological needs and simulate natural texts, allowing students to obtain more realistic psychological feelings and break through psychological

barriers and improve their psychological state through conversations with virtual teachers.

4.3 Application Of Artificial Intelligence In Prevention Of Psychological Problems

Colleges and universities need to fully recognize the importance of student mental health education, enhance the importance of preventing psychological problems, strengthen the popularization of mental health knowledge, and enable students to face psychological problems squarely, in order to better prevent psychological problems from the root and improve their mental health level.

5. CONCLUSIONS

In summary, after entering the new era, mental health problems among college students have become frequent. Strengthening mental health education for college students is an extremely important task for universities. There are still certain shortcomings in the previous mental health education for college students, and there is still a significant gap between the expected guidance effect of mental health education. Seizing the opportunities brought by artificial intelligence and improving the mental health education system are tasks that all universities should actively implement. Therefore, mental health education workers in universities need to fully recognize the value of artificial intelligence, innovate mental health education mechanisms with the help of artificial intelligence, achieve real-time collection and updating of students' psychological data, establish intelligent analysis models, reasonably evaluate students' psychological states, carry out intervention work in a timely manner based on the evaluation results, and strengthen psychological problem warning to ensure the mental health level of college students.

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A Study on the Pathways and Mechanisms of Industry-Education Integration in Vocational Education

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Abstract: Industry-education integration in vocational education is a crucial direction for China's current vocational education reform and a key pathway to enhance the quality of talent cultivation and support regional economic development. This paper begins with the connotation and significance of industry-education integration in vocational education, systematically analyzes the main challenges faced in this process, explores the implementation pathways and the construction of long-term mechanisms, and proposes optimization recommendations. Research indicates that measures such as deepening school-enterprise collaboration, innovating integration models, and improving policy safeguards can effectively promote the deep integration of vocational education and industrial development, achieving organic alignment between the education chain, talent chain, and industrial chain.

Keywords: Vocational Education; Industry-Education Integration; School-Enterprise Collaboration; Long-Term Mechanism

1. THE CONNOTATION AND SIGNIFICANCE OF INDUSTRY-EDUCATION INTEGRATION IN VOCATIONAL EDUCATION

Industry-education integration in vocational education refers to the deep alignment and organic fusion between vocational education and industrial development, with its core lying in the close integration of educational processes and production processes through school-enterprise collaboration. Essentially, industry-education integration is a distinctive feature that sets vocational education apart from general education and a central component of modern vocational education systems.

The integration of industry and education has multiple values: firstly, it improves the quality of talent cultivation by transforming production factors such as enterprise standards, technology, and equipment into teaching resources, enabling students to master practical skills that meet industry needs; the second is to promote industrial transformation and upgrading, provide high-quality technical and skilled talents for enterprises, and solve the problem of "difficult employment"; the third is to promote regional economic development and form a virtuous cycle of education service industry and industry feedback on education. At present, China has identified 21 national pilot cities for the integration of industry and education, cultivated more than 4600 industry education integration enterprises, and initially formed a promotion mechanism of "cities as nodes, industries as pivot points, and enterprises as focus".

2. THE MAIN PROBLEMS FACED BY THE INTEGRATION OF INDUSTRY AND EDUCATION IN VOCATIONAL EDUCATION

Although there has been some progress in the integration of industry and education, there are still many obstacles in practice:

Firstly, the phenomenon of "hot schools and cold enterprises" is widespread. Some enterprises lack motivation to participate, and school enterprise cooperation remains at the level of agreements or simple labor employment, failing to delve into the entire process of talent cultivation. This is mainly due to factors such as high cooperation costs, long profit cycles, and unclear division of responsibilities.

Secondly, the level of integration is relatively shallow. Some vocational colleges have majors that lag behind industrial development,

with course content disconnected from job demands and insufficient practical training conditions, resulting in a gap between students' skills and enterprise requirements.

Again, the institutional safeguards are not perfect. At present, there is a lack of effective incentive mechanisms and evaluation systems, and there are many obstacles for both schools and enterprises in terms of resource sharing and benefit distribution. Especially in key issues such as asset management and intellectual property ownership, there is a lack of clear regulations.

Finally, regional development is uneven. the degree of integration between industry and education in the eastern region is generally higher than that in the central and western regions, and there are significant differences between different professional fields. the integration of modern service industries and strategic emerging industries is relatively lagging behind.

3. THE IMPLEMENTATION PATH OF INDUSTRY EDUCATION INTEGRATION IN VOCATIONAL EDUCATION

3.1 Deepen the innovation of school enterprise cooperation mode

School enterprise cooperation is the basic carrier of industry education integration, which needs to move from singularity to diversity: firstly, jointly building industrial colleges, such as Zibo Vocational and Technical University cooperating with enterprises to establish a digital finance and economics industry college, introducing enterprise production projects into teaching; the second is to implement a modern apprenticeship system, implementing the principle of "recruiting students and entering enterprises as soon as they enter school", and pairing students with enterprise masters for training; the third is to jointly build training bases, construct "school in factory" and "factory commander" according to enterprise production standards, and provide students with a real professional environment. Only by achieving deep integration between schools and enterprises, forming a "long-term cooperation, mutual benefit and win-win" mechanism, can the adaptability of talent cultivation be effectively improved.

3.2 Expand the integration of content and form

The integration of industry and education should be expanded from single skill training to comprehensive docking: in terms of professional construction, a dynamic adjustment mechanism should be established to timely add emerging majors such as artificial intelligence and new energy, and eliminate backward majors; In curriculum development, integrate vocational standards into curriculum standards and jointly develop modular courses; In terms of teacher development, we will implement mutual recruitment of personnel between schools and enterprises, and increase the proportion of "dual teacher" teachers; In terms of technological research and development, we will jointly build a technology innovation platform and tackle industry challenges.

3.3 Promote digital transformation

The School Planning and Construction Development Center of the Ministry of Education proposes to build a digital and intelligent platform for the integration of industry and education, and accelerate the construction of high-quality vocational education. Digital technology provides new opportunities for the integration of industry and education, and both schools and enterprises can promote digital transformation through the following ways: firstly, building virtual simulation training platforms and developing digital teaching resources; the second is to apply blockchain technology to establish a credit bank and education certification system, enhancing the credibility of learning outcomes; the third is to use big data to analyze the talent demand in the industry and guide the optimization of professional layout.

4. CONSTRUCTION OF A LONG TERM MECHANISOM FOR THE INTEGRATION OF INDUSTRY AND EDUCATION IN VOCATIONAL EDUCATION

4.1 Improve the policy incentive system

Cracking the problem of 'unity but non integration' requires a combination of policy measures. the Implementation Plan for Enhancing the Integration of Industry and Education in Vocational Education, jointly

issued by the National Development and Reform Commission and eight other departments, has established a systematic policy support framework. In terms of finance, banks are encouraged to provide preferential loans for industry education integration projects; In terms of finance, a 30% tax credit will be given to enterprises investing in vocational education; In terms of land, priority will be given to ensuring educational land for school enterprise cooperation construction projects; In terms of credit, incentives such as commendation and recognition will be given to companies with outstanding performance.

4.2 Establish a sound governance structure

Establish a collaborative governance mechanism involving multiple parties: firstly, establish a vocational education group or council composed of government, school, enterprise, and industry, and clarify the division of responsibilities; Secondly, formulate a school enterprise cooperation charter to regulate cooperative behavior; the third is to establish a third-party evaluation system to assess the effectiveness of integration from multiple dimensions such as technology conversion rate, enterprise satisfaction, and employment matching.

4.3 Strengthen regional collaboration

Implement classified promotion strategy: For areas with good foundations, support the construction of industry education integration cities, such as the first batch of 21 pilot cities; For vocational colleges, encourage high-level colleges to focus on technological research and development, and liberal arts colleges to connect with regional cultural characteristics; For enterprises, the focus is on guiding industry leaders to deeply participate, forming a pattern of "leading by the head and overall follow-up".

5. CONCLUSION AND PROSPECT

The integration of industry and education in vocational education is a systematic project that requires collaboration from multiple parties including the government, industry, enterprises, and schools. In the future, we should deepen from three aspects:

One is to strengthen top-level design and incorporate the integration of industry and education into regional development strategies. At the national level, it is necessary to further improve the policy system and promote local governments to incorporate industry education integration into regional industrial planning. At the same time, policies such as special bonds, tax incentives, and land transfer support can be implemented to encourage enterprises to participate deeply.

The second is to stimulate the endogenous motivation of enterprises and innovate cooperation models. Encourage enterprises to deepen the integration of industry and education through shareholding reform, mixed ownership education, and other means, jointly build training bases between schools and enterprises, lead talent training programs by enterprises, and solve the problem of "hot schools and cold enterprises". In addition, schools can collaborate with upstream and downstream enterprises in the industry chain to jointly cultivate talents, forming a closed-loop ecosystem of "enrollment training employment".

The third is to promote the localization of international experience and create a model with Chinese characteristics. Drawing on the experiences of Germany's "dual system" and Singapore's "teaching factory", combined with China's actual innovative practices. In the future, we can further explore the integration of science and education, promote the joint construction of industrial colleges and technology research and development centers between vocational colleges and enterprises, and enhance the matching between talent cultivation and industry demand.

With the improvement of the policy system and the deepening of practical exploration, the integration of vocational education and industry will inevitably become a "booster" for industrial development, providing solid technical and skilled talent support for the comprehensive construction of a socialist modernized country.

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The Current Research Status of Communication Skills Between Nursing Students and The Elderly

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Abstract: As an important reserve force to meet the high nursing needs of aging services, vocational nursing students themselves face the reality of weaker learning and communication abilities compared to undergraduate and graduate students. Therefore, vocational nursing students need to receive more help and improve their professional skills before entering the workforce, among which communication skills are one of the most important aspects.
Keywords: Communication ability; Vocational nursing students

1. COMMUNICATION SKILLS BETWEEN NURSING STUDENTS AND THE ELDERLY

Nurse-patient communication is the core and key of clinical nursing communication work, with the most professional characteristics and the best reflection of students' professional communication skills. Elderly patients have the characteristics of multiple diseases coexisting, functional decline or even loss, atypical clinical manifestations, and communication difficulties. Nurses need to have high nursing abilities in order to timely identify clinical changes and win treatment opportunities. This study chose communication between nursing students and the elderly as the research objective, considering the characteristics of nursing profession and student ability assessment.

2. THE IMPORTANCE OF COMMUNICATION SKILLS FOR NURSING STUDENTS

2.1 Research Object

Perhaps because nurses are an important component of front line clinical work, there is a lack of research and investigation on the communication skills of nurses both domestically and internationally. Additionally, there is a scarcity of research specifically focused on communication skills with elderly individuals. For example, many researchers have conducted surveys on the communication skills of oncology nurses [1], emergency department nurses [2], ICU nurses, etc. the results show that there is a correlation between communication skills and conflict resolution methods [3], as well as occupational burnout. Clinical nurses have solid basic knowledge and excellent operational skills, and their basic professional ethics and level have been recognized by patients, but their communication skills need to be improved [4].

The research on communication skills conducted for nursing students is almost exclusively focused on selecting intern nursing students as research subjects, without including other lower grade nursing students who are still in school. Moreover, there have been more studies conducted on undergraduate nursing students in terms of academic degree selection, while research on vocational college students is not yet sufficient. Most of the research conducted focuses on the learning level of nursing students during their school years, such as learning engagement level, career planning level, learning attitude, etc., and tends to be more focused on the overall learning status. Moreover, most of the research focuses on the learning of professional course knowledge, without delving into the exploration of communication skills learning status. This may be because nursing students are not truly engaged in nursing work, so they have not yet received attention from hospital managers and researchers, and research on current students is mostly focused on cultural knowledge learning.

2.2 Research on influencing factors

Patient nurse communication is a complex, open, and interactive system that is influenced by multiple factors. Including factors related to nursing workers, such as their personality traits, professional knowledge and skills, professional emotional attitudes, basic communication knowledge, and nurse patient communication skills. Patient factors, such as the patient's disease type, condition, personality traits, cultural background, etc. Communication situational factors, such as the time environment, spatial environment, and information dissemination channels of communication. In the process of nurse patient communication, it is necessary to eliminate various factors that hinder information communication and promote smooth communication. However, overall, there are more studies on nurse patient communication conducted for clinical nurses and intern nursing students, but there is a lack of research specifically on the communication status between nursing staff, nursing students, and the elderly, and there is also a lack of research on the influencing factors related to this.

2.2.1 Acceptance of nurse patient communication courses by nursing students

Training plays an important role in improving the therapeutic communication skills of nursing students, and nursing students who participate in relevant training score better in therapeutic communication skills than those who do not participate in training [5]. Research [6] has shown that the acceptance of nurse patient communication courses by nursing students has a significant impact on their communication skills. Nursing students who have not received nurse patient communication courses score the lowest in nurse patient communication skills, while some nursing students who have received courses score second highest; Nursing students who have received nurse patient communication courses score the highest in nurse patient communication skills.

In the process of cultivating nursing students, attention should be paid to the development of doctor-patient communication courses for nursing students, and corresponding course guidance should be formulated. And the current nursing education should focus on developing specialized learning modules for communication with the elderly in elderly care, humanities education, practical operation courses, and pre internship training, in order to prepare for the cultivation of nursing talents engaged in elderly care.

2.2.2 Lack of communication skills

The patient's distrust and lack of communication ability are important factors that significantly affect the nurse patient communication ability during the nurse patient communication process [6]. Research [7] has shown that during internships, nursing students often have conflicts with patients, which leads to disputes between nurses and patients. This is due to the inability of vocational nursing interns to effectively communicate, making it difficult to identify and point out patients' inner concerns, psychological and social issues, etc. Their communication skills still have a lot of room for improvement, and the overall level of communication skills needs to be improved.

Moreover, as a critical period for improving the communication skills of nursing students, the supervising teachers attach great importance to the learning of operational skills and nursing safety for interns, but pay insufficient attention to the cultivation of clinical communication abilities for nursing students. And most of the teaching staff themselves lack good communication skills, such as poor attitude and perfunctory language during the communication process, which cannot set a good example. Therefore, this reminds us that whether we are nursing instructors in schools or teaching staff in internship hospitals, we must first increase our emphasis on communication skills, and then improve our own skills.

2.2.3 Sociol-demographic Characteristics

The social demographic characteristics of nursing students (such as age, gender, etc.) and personal psychological factors (such as attitudes towards the nursing profession) can affect the interaction between nursing students and patients [8]. Research [5] shows that nursing students with a bachelor's degree, holding positions such as class monitor during their school years, being non only children, and coming from urban areas have higher scores in therapeutic communication skills. Attitude towards nursing profession is an important influencing factor on

communication effectiveness [9], and students interested in nursing profession attach more importance to communication with patients, clinical teachers, classmates, etc. Ye Qian's [10] research found that there are differences in the performance of nurse patient communication skills among students from the same university who intern in different hospitals, indicating that different internship hospitals may affect the cultivation and improvement of nurse patient communication ability.

3. CONCLUSION

Actually, nursing students are the true reserve force of nurses. If nursing students do not have sufficient skills to cope with clinical nursing work and cannot communicate well with elderly patients, it is actually a waste of educational resources. Therefore, we need to prioritize the issue and improve the humanistic care abilities of nursing students before they graduate and become nurses, with a particularly important aspect being their communication ability with the elderly. If we simply wait until nursing students start working and find that their communication skills are insufficient before improving, it may result in duplication and waste of human resources. Moreover, nurses themselves face significant pressure from practical assessments and exams in clinical practice. Increasing training may also take up more rest time for nurses, affecting their job satisfaction.

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The Dilemma and Countermeasures of Implementation Pathway for Digital Transformation in University Archival Management

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Abstract: Leveraging information technology to empower management reform and propel the modernization of archival operations has emerged as a critical mandate for Chinese higher education institutions in advancing digital transformation within archival management. This paper examines the practical challenges confronting this digital transformation through three analytical dimensions: archival talent cultivation, the development of archival governance frameworks, and the optimization of archival utilization mechanisms. It elucidates how archival operations can synchronize with modernization initiatives to enhance resource utilization efficiency, optimize service efficacy, and maximize archival value. Furthermore, the study underscores the pivotal role of digitized archival management in fostering sustainable innovation-driven development for academic institutions within the context of contemporary societal demands.
Keywords: University Archival Management; Digital Transformation

1. INTRODUCTION

The archives of higher education institutions serve as crucial instruments for documenting institutional heritage, facilitating educational activities, and supporting scientific research innovation. They play an irreplaceable role in enhancing administrative efficiency and promoting sustainable development. Under new circumstances, fully realizing the value of university archives requires continuous activation of digital technologies in archival management, enabling archival resources to be integrated more rapidly, shared more easily, disseminated more widely and in more diverse forms, thereby meeting the usage demands of diverse groups including faculty, students, administrators, and socio-historical researchers. Simultaneously, it provides decision-makers with more precise, comprehensive, and rapid informational support. Consequently, the digital transformation of university archival management has become an inevitable necessity.

2. CHALLENGES IN DIGITAL TRANSFORMATION OF UNIVERSITY ARCHIVAL MANAGEMENT

2.1 Shortage of Digitally Competent Archival Professionals

At present, Universities gradually increase the archive education and training efforts to strengthen technical skills of the archival management teams, but the average age of the archivists in universities can be relatively old and many of them lack of information technology capabilities, most of them may received short-term training instead of systematic learning, it is difficult for them to master the data organization and analysis, metadata indexing, data format conversion, information security and other related technologies. As a result, there is a serious shortage of professionals with digitization backgrounds, and the team as a whole is facing the double challenge of upgrading work requirements and technical capacity faults. In the long run, this situation will lead to the implementation of the requirements of the comprehensive archiving of electronic documents is not in place, which is not conducive to standardizing the university electronic document archiving and electronic

archives management work. In addition, the lack of digital workforce support for university archival management has, to a certain extent, constrained the enhancement of its archival services and development capabilities, and the process of digital transformation of archival management has been seriously constrained.

2.2. Inadequate institutional system to support the digital transformation of archival management

University archival management is a rather huge, complicated systematic project, with strict regulations to ensure that the standardization of the management system is one of the most important elements of the construction of digital management of college archives [1]. However, after researching the current systems of archival management system in several colleges and universities, it is safe to say that most of them are merely following the regulations of the past or rigidly imitating superior policy with no adjustment for their own situation [2]. In terms of assessing and motivating the archivists, the existing assessment and incentive systems are still focusing on the collection, organization and filing of traditional paper archive materials, and no evaluation system has been established that includes "contribution of data governance" and other indicators about digital transformation. As a result, archival management personnel focus more on organizing paper materials and neglect the use of digital technology, data-oriented thinking and intelligent cognition to innovate archival workflows. In the construction of archival management informatization, there are no standards to follow for some archival workflows, and the current regulations are seriously inconsistent with the actual work and future development direction. In addition, most of the university archive governance specifications lack electronic file encryption and storage rules, and there is a risk of leakage of sensitive archive information.

2.3 Insufficient empowering effect of digitized archive data

In the context of digitization, the sharing of university archival resources has been greatly strengthened, and can be implemented through the promotion of the integration of sharing platforms, as well as the participation of big data, cloud computing, artificial intelligence and other new-generation technologies. However, in practice, there is still a certain gap between archive data empowerment and the high-quality development brought about by digital transformation, which is specifically reflected in the following areas: firstly, the sharing of archive information in universities is highly insufficient, the information available for inspection and use of university archives is still in the form of paper, the information retrieval and sharing of various types of archive resources is inefficient, thereby the service for teachers, students and other scientific and practical activities of the society is not ideal; secondly, the exploitation of the value of archival data is insufficient, the number of college archives is rapidly increasing, which contains rich information resources and knowledge value, and can be driven to produce huge social and economic benefits, but at present, these potential values have not been fully excavated and utilized, resulting in limited role of archive data in supporting decision-making, promoting scientific research, and enhancing the quality of education. Thirdly, the utilization efficiency of archives is rather low, under the traditional concept of "attaching importance to storage and neglecting utilization", it is generally difficult to realize the innovation of archives utilization and useful exploration of the role of archives.

3. DIGITAL TRANSFORMATION STRATEGIES FOR UNIVERSITY ARCHIVAL MANAGEMENT

3.1 Optimize the personnel structure, focusing on digital archival management team building

To address the issue of insufficient digital capabilities in university archival management teams, efforts can be made to recruit talents, improve training and development mechanisms, and establish special funds to motivate relevant personnel. First of all, colleges and universities should develop specialized talent recruitment plans, explicitly require candidates to master data governance, metadata indexing, information security and other core technologies, thus absorbing composite talents with professional

both archival management experience and digital backgrounds. Secondly, establish a hierarchical, targeted and systematic training system, combining short-term skills training with long-term academic education. Which means on the one hand, introducing the technical resources of digital archive management system development companies through school-enterprise cooperation projects, and jointly carry out the "digital archive management training courses", covering data format conversion, application of intelligent retrieval tools and other practical contents. On the other hand, it encourages for the in-service archivists to pursue interdisciplinary doctoral research projects in archival science and information technology, so as to enhance the reserve of talents in digital archives. Thirdly, a special incentive fund for digital transformation should be set up to motivate the initiative of applied talents in theoretical innovation, technological innovation and institutional innovation, so as to gradually alleviate the problem of talent shortage.

3.2 Strengthen the institutional guarantee and build a management system suitable for digital transformation

When reconstructing the relevant systems for the digital transformation of university archival management, it is necessary to strengthen the assessment and incentives of management team members, while promoting the standardization of management processes and the systematization of data security [3]. First of all, improve the evaluation system of archive personnel, "data governance contribution", "system operation and maintenance capabilities" and other indicators should be integrated into the assessment and evaluation system, while the achievements in digital transformation should be included in the scope of professional title promotion recognition, in order to effectively stimulate the work enthusiasm of archival management personnel. Secondly, establish a digital standard system that covers all the workflows, including metadata specifications, data format conversion protocols, cross system interface standards, etc. At the same time, clarify that the school's personnel, academic affairs, finance, scientific research and other business departments should implement unified standards, break down barriers between archive data departments, making standardized processes the basis for system compatibility and data sharing. In addition, electronic archival management measures should be formulated to clarify security measures such as electronic archive encryption procedures, access permissions, and traceability mechanisms, strengthen data security protection, and avoid data leakage risks.

3.3 Deepen technological empowerment and create an integrated data application ecosystem

In order to crack the dilemma of insufficient data empowerment effect of university archives, it should be driven by technology to build a data sharing platform, develop intelligent analyzing tools, and innovate service modes. First of all, promote the construction of cross-departmental data sharing platform, integrate the archive resources of academic affairs, scientific research, personnel and other systems, and with the help of cloud computing technology, building a university-level archive data center. Second, introduce big data, artificial intelligence and other technologies to mine the value of archives, develop personalized archive service system, and provide data support for teachers' scientific research, teachers' career development planning, and students' employment consulting. At the same time, deepen the exploration of the social benefits of university archive data, such as integrating archive resources into the construction of school theme exhibitions, school history museums, cultural corridors, etc., and developing school history and culture IP, to realize the win-win situation of both social benefits and economic benefits, fully releasing the knowledge value of archive data and the potential of achieve services, promoting the archival management of colleges and universities to transform from the "storage warehouse" to the "intelligent engine".

4. CONCLUSION

The digital transformation of university archival management is a long-term and systematic project, which puts forward the requirements of strengthening the training of

archive talents, strengthening the construction of archive governance system and the construction of archive utilization system for colleges and universities. Colleges and universities should broaden channels for talent cultivation, improve talent evaluation mechanisms, implement standardized archive construction projects, promote the integration of shared platforms, enhance archive service and development capabilities, and achieve breakthroughs in digital transformation of archival management.

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Research on Cultivating Psychological Resilience in University Students from the Perspective of Ideological and Political Education

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Abstract: Currently, university students face numerous pressures, and psychological resilience has become a key ability. This study explores the connotation and significance of psychological resilience and the current situation of university students from the perspective of university ideological and political education. It analyzes the unique advantages of ideological and political education in cultivating psychological resilience in areas such as value guidance, shaping the view of adversity, and fostering collective strength. It proposes specific practical pathways for integrating the cultivation of psychological resilience into ideological and political courses, campus activities, and individual guidance, aiming to provide reference for improving the psychological well-being of university students.

Keywords: Psychological resilience; Ideological and Political Education; University students; Cultivation pathways; Psychological health

1. INTRODUCTION

With rapid social development, university students face complex challenges such as academics, employment, and interpersonal relationships. Psychological health issues cannot be ignored, making the cultivation of psychological resilience particularly important. Psychological resilience is a key psychological quality that measures an individual's ability to cope with adversity and adapt positively. As the core of moral and talent cultivation in universities, ideological and political education not only shapes students' ideological and moral character but also subtly influences their psychological quality. the spiritual qualities emphasized by ideological and political education, such as ideals and beliefs, and collectivism, are highly compatible with the intrinsic requirements of psychological resilience. How to effectively leverage the advantages of ideological and political education and integrate the cultivation of psychological resilience into the ideological and political education system is an important topic in current university ideological and political work. This study aims to explore the mechanism of action of ideological and political education in the cultivation of psychological resilience among university students and propose practical strategies.

2. PSYCHOLOGICAL RESILIENCE: CONNOTATION, SIGNIFICANCE, AND ANALYSIS OF THE CURRENT SITUATION OF UNIVERSITY STUDENTS

2.1 Connotation and Definition of Psychological Resilience

The concept of psychological resilience originated from long-term follow-up studies on high-risk children, finding that some children could grow up healthy despite facing severely adverse conditions. [1] Its core lies in the process of positive adaptation when individuals face adversity. Definitions of psychological resilience vary internationally, but it is widely agreed to be a dynamic, developable capacity rather than a fixed personality trait. It involves the interaction between the individual and the environment, manifested as the ability to maintain or quickly restore physical and mental

functioning in unfavorable situations. Specific constituent elements include: positive self-perception, effective emotion regulation, flexible problem-solving skills, good interpersonal relationships, and positive expectations for the future, among others. In short, psychological resilience is the inner strength to "bounce back from the bottom" and "grow towards the sun. "

2.2 The Important Significance of Psychological Resilience for University Students

For university students who are at a critical transitional stage in life, psychological resilience is of extraordinary importance. the university stage is a high-pressure period where academic challenges, interpersonal adjustments, emotional exploration, and career planning occur simultaneously. High psychological resilience can help university students effectively cope with academic pressure. When facing challenges like heavy coursework or exam failures, highly resilient students can better adjust their mindset, maintain learning motivation, and learn from failure; Deal with interpersonal and emotional difficulties, being able to handle dormitory relationships, peer conflicts, emotional setbacks, etc., more maturely, and maintain a healthy social circle; Adapt to environmental changes and setbacks. When facing transitions in campus life, social complexity, employment competition, etc., they can adapt more quickly and not give up easily; Maintain physical and mental health, which helps reduce the impact of negative emotions such as anxiety and depression, and maintain a positive and optimistic attitude.

2.3 Analysis of the Current Situation of Psychological Resilience among University Students

Although psychological resilience is so important for university students, some segments of the current university student population exhibit insufficient psychological resilience. This is related to multiple factors, including some only children experiencing fewer setbacks during their growth, increased social competition pressure, fragmentation of online information, and the proliferation of negative information, among others. Prominent manifestations include relatively weak stress resistance, where even minor setbacks can trigger strong emotional reactions such as excessive anxiety, frustration, or even breakdown; Difficulty in emotional regulation, struggling to effectively manage negative emotions, easily falling into emotional lows, and recovering slowly; Limited or negative coping styles, potentially tending towards avoidance, complaining, or using unhealthy coping mechanisms (such as excessive online indulgence); Self-evaluation easily influenced by external factors: Self-confidence and self-worth are easily shaken by external evaluations or a single failure.

3. UNIQUE ADVANTAGES OF IDEOLOGICAL AND POLITICAL EDUCATION IN CULTIVATING PSYCHOLOGICAL RESILIENCE

3.1 Value Guidance and Construction of Spiritual Pillars

Ideological and political education helps university students establish correct worldviews, outlooks on life, and values through systematic theoretical learning and ideological guidance. Firm ideals and beliefs and correct value pursuits are the intrinsic "resolve" for coping with external challenges. Ideological and political education guides students to recognize that personal growth is closely linked to the destiny of the nation and social development, cultivating patriotism and a sense of social responsibility, enabling them to find their own value and meaning in serving society. This value support provides students with strong spiritual motivation, making it less likely for them to lose direction when facing difficulties, allowing them to view setbacks as tempering rather than dead ends, and is an important ideological basis for psychological resilience.

3.2 Shaping the View of Adversity and Positive Coping Strategies

Ideological and political education emphasizes educating students about adversity and setbacks. By narrating the struggle stories of revolutionary martyrs and model figures of the era, it guides students to correctly understand difficulties and failures, viewing them as normal occurrences in life and catalysts for growth. [2] This helps students form a positive view of adversity, namely that "failure is the mother of success, " and stimulates their intrinsic drive to learn

and reflect from adversity. At the same time, ideological and political education cultivates students' dialectical thinking and problem-analysis abilities, enabling them to view problems rationally, seek solutions, and enhance their practical capacity to cope with complex situations, which is the manifestation of psychological resilience at the behavioral level.

3.3 Fostering Collective Strength and Social Support Network

Ideological and political education advocates the spirit of collectivism and the awareness of mutual assistance and cooperation. By organizing class, party branch, and youth league activities, it encourages students to integrate into the collective, experience collective warmth, and establish deep interpersonal relationships. Good social support is an important external resource for enhancing psychological resilience. the collective atmosphere and interpersonal network built by ideological and political education enable students to receive care and help from classmates, teachers, and organizations when they encounter difficulties. This support from the collective effectively alleviates students' psychological pressure and enhances their confidence and courage in facing challenges, serving as an indispensable external guarantee for the cultivation of psychological resilience.

4. PRACTICAL PATHWAYS FOR CULTIVATING PSYCHOLOGICAL RESILIENCE IN UNIVERSITY STUDENTS THROUGH IDEOLOGICAL AND POLITICAL EDUCATION

4.1 Integrating Psychological Resilience into the Ideological and Political Course System

Ideological and political theory courses should organically integrate content related to psychological resilience. When teaching relevant theories, teachers can combine them with the actual experiences and psychological characteristics of university students, introducing the concept, significance, and methods of cultivating psychological resilience. For example, when analyzing ideals and beliefs, they can be combined with setbacks in academics or employment, emphasizing the supportive role of beliefs in overcoming difficulties; When teaching patriotism and collectivism, examples of role models who persevered and struggled in adversity can be introduced to inspire students' spirit of struggle and teamwork awareness. Interactive teaching methods such as case analysis, thematic discussions, and role-playing can be used to guide students in thinking and practicing, enhancing their psychological cognition and coping abilities.

4.2 Expanding the Educative Function of Campus Cultural Activities

Campus cultural activities are important platforms for nurturing students' minds and enhancing psychological resilience. Universities should organize diverse cultural and sports activities around themes such as "Growth in Adversity" and "Sunny Psychology. " For example, holding sharing sessions and thematic essay competitions to encourage students to share experiences of overcoming difficulties; Organizing outdoor expansion activities and sports competitions to enhance students' stress resistance and self-confidence through exercise and teamwork; Inviting alumni or social figures to share inspiring stories of struggling through adversity, using the power of role models to motivate students. [3] A positive and healthy campus cultural atmosphere helps guide students to establish correct attitudes towards life and build positive peer relationships, thereby strengthening psychological resilience.

4.3 Strengthening Individual Guidance and Multi-Party Collaboration

Ideological and political teachers (including counselors and class advisors) as direct contacts for students' thoughts and psychology, should enhance their own psychological health literacy and crisis identification ability. In daily interactions with students, pay attention to their emotional and behavioral changes, timely identify signs of psychological distress, and provide initial psychological support and guidance. For students with deeper psychological needs, they should be timely referred for professional help by collaborating with the psychological health education center. At the same time, strengthen communication and collaboration with families, departments, and relevant units to build a collaborative education mechanism

involving the school, family, and society, forming synergy between psychological health education and ideological and political education, and providing students with a comprehensive, multi-level support system.

5. CONCLUSION

Psychological resilience is an important psychological quality for university students to adapt to society and achieve personal development. University ideological and political education provides a unique perspective and advantages for cultivating psychological resilience in university students in terms of value guidance, shaping the view of adversity, and fostering collective strength. In the future, universities should place greater emphasis on the deep integration of ideological and political education and psychological health education, embedding the cultivation of psychological resilience throughout all aspects of ideological and political course teaching, campus cultural activities, and individual guidance, and building a collaborative education mechanism. This will not only improve the psychological health level of university students and enhance their ability to face challenges but also cultivate new talents of the era who are mentally strong and courageous in taking responsibility.

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Some Thoughts on Integrating Ideological and Political Elements into the Teaching of the "Prefabricated Building Engineering Cost" Course

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Abstract: With the in-depth advancement of ideological and political education in higher vocational education courses in the new era, the integration of professional courses and ideological and political education has become an important direction of teaching reform. This article takes the course "Cost Estimation of Prefabricated Building Engineering" as an example to explore the necessity of integrating ideological and political elements into professional courses, as well as the implementation paths and effects. By exploring the ideological and political main line in the course, starting from eight teaching modules including an overview of prefabricated buildings, cost estimation principles, cost composition and calculation procedures, application of valuation quotas, and calculation of prefabricated component quantities, we design ideological and political entry points and explore teaching implementation approaches. Practice has shown that the integration of ideological and political elements can enhance students' sense of professional mission, craftsmanship and social responsibility, and provide inspiration for cultivating well-rounded engineering cost professionals.

Keywords: Prefabricated Building; Curriculum-based Ideological and Political Education; Dual Carbon Goals

1. THE NECESSITY OF INTEGRATING IDEOLOGICAL AND POLITICAL ELEMENTS INTO PROFESSIONAL COURSES

1.1 The actual needs of national strategic development

Prefabricated buildings, as a form of green construction, carry the important mission of achieving the "dual carbon goals". the "14th Five-Year Plan for the Development of the Construction Industry" issued by the Ministry of Housing and Urban-Rural Development (hereinafter referred to as the "Plan") proposes that by 2025, prefabricated buildings will account for more than 30 percent of new buildings; the amount of construction waste discharged from new construction sites will be controlled to less than 300 tons per 10, 000 square meters, the market mechanism for the treatment and reuse of construction waste will be initially formed, and a number of green construction demonstration projects will be built. the concept of ecological and environmental protection is conveyed through the prefabricated cost course, which is in line with the national sustainable development strategy.

1.2 Respond to the demand for high-quality development of the industry

The prefabricated building industry, as an important direction for the modernization of the construction industry, not only requires cost estimators to have solid professional knowledge and excellent skills, but also professional qualities such as rigorous work attitude, innovative spirit and teamwork awareness. By integrating ideological and political elements into the curriculum, it is possible to cultivate students' professional spirit and moral norms in line with the development needs of the industry, enabling them to better adapt to the development of the industry and providing a strong talent support for the healthy development of the prefabricated building industry.

1.3 The inherent requirements of teaching

reform

The Ministry of Education's "Guidelines for the Construction of Ideological and Political Education in Higher Education Courses" clearly states that professional courses should explore ideological and political elements to achieve the unity of knowledge imparting and value guidance. the fundamental task of education is to cultivate virtue and nurture people. Teaching courses in colleges and universities should not only impart professional knowledge and skills, but also cultivate students' correct worldviews, outlooks on life and values. As a core course for construction-related majors, "Prefabricated Building Engineering Cost" integrates ideological and political elements, which can imperceptibly guide students to establish correct value orientations in the process of professional knowledge teaching, enabling students to master the professional skills of engineering cost while having good moral qualities and a sense of social responsibility, truly achieving the goal of cultivating virtue and nurturing people.

2. THE INTEGRATION OF IDEOLOGICAL AND POLITICAL ELEMENTS WITH THE COURSE MODULES

The course "Cost Estimation of Prefabricated Building Engineering" is rich in ideological and political elements. According to the course content, three main lines of "low-carbon responsibility line - professional ethics line - craftsmanship manufacturing line" are constructed to run through the course. Low-carbon responsibility line: Runs through modules 1-2-6 and nurtures ecological responsibility awareness through carbon emission measurement and circular economy cases. Professional ethics line: Focus on module 3-5-7, set up a "Cost Engineer's Choice" scenario simulation, and incorporate professional ethics education in the application of quotas, visa changes, etc. Craftsmanship Manufacturing Line: In combination with modules 4-8, introduce the practice of making Lu Ban locks to experience the spirit of craftsmanship in quota calculation, which can be distinguished by the difference of a millimeter.

Then match the ideological and political elements according to the chapter content and the constructed ideological and political main line. For example, in the chapter on the overview of prefabricated buildings, by telling examples around us, such as the Zibo Expressway and the East Campus of Zibo Vocational College, these cases convey the spirit of craftsmanship, the concept of green development, the spirit of scientific and technological innovation and the sense of social responsibility, which inspire students to pursue professional knowledge at the same time Establish correct values and a sense of mission, and strive unremittingly to achieve the "dual carbon goals" and build a modern socialist power. the chapter on cost composition and calculation procedures describes the more than HK $5.4 billion overruns on reclamation and port facilities at the Hong Kong port of the Hong Kong-Zhuhai-Macao Bridge project. From the perspective of economic laws, this case warns us to respect market rules and establish a scientific awareness of cost control. the construction industry is significantly influenced by market supply and demand, and fluctuations in the prices of factors such as labor, materials, and machinery are inevitable. As future engineering cost practitioners, we should not just stay at the level of formula calculation and quota application, but also actively pay attention to the macroeconomic situation and enhance market insight. In the early stage of project planning, price fluctuations should be fully considered, dynamic cost management thinking should be applied, and reasonable risk reserves should be reserved to avoid cost runaway due to underestimation of the market. This sense of awe and proactive adaptation to economic laws is precisely the professional quality that engineering cost workers must possess, and it is a vivid interpretation of the "pragmatic, scientific and rigorous" working attitude.

3. THE PATH OF INTEGRATING IDEOLOGICAL AND POLITICAL ELEMENTS INTO THE CURRICULUM

3.1 Pre-class: Laying the foundation of ideological and political cognition

3.1.1 Sort out ideological and political materials and build a resource library

Centering on the three main lines of "low-

carbon responsibility line", "professional ethics line" and "craftsmanship manufacturing line", systematically sort out the policy documents, typical cases and industry norms of prefabricated buildings. For example, sort out digital resources such as the development goals of prefabricated buildings in the "14th Five-Year Plan for the Development of the Construction Industry" and the video of the cost control case of the Hong Kong-Zhuhai-Macao Bridge to form a "course-based ideological and political resource package".

3.1.2 Design preview task sheets and set up thought-provoking questions. For example, before the "Calculation of Quantities of Prefabricated Components" module, publish cases of engineering accidents caused by production errors of prefabricated components to guide students to think about "What chain reactions could a 1-millimeter error cause?"

3.2 In lesson 2: Deepen value guidance

3.2.1 Situational simulation method: Immersive career experience

For the "Visa Change Management" module, create the "Abnormal Fluctuations in material prices" scenario. Students are grouped to play the roles of the construction party, the contractor, and the supervisor, and engage in a game simulation around the HK $5.4 billion overspending case to understand the dialectical relationship between "adhering to the bottom line of the profession" and "serving the national strategy" in the practice of cost accounting.

3.2.2 Interactive discussion method: Stimulate value resonance

In the "Valuation Quota Application" section, organize a debate competition on whether quota application is equivalent to reading from a book. By analyzing the contradiction between innovative construction methods of prefabricated buildings and traditional quotas, students will be guided to understand the dialectical relationship between the implementation of norms and technological innovation, and critical thinking will be cultivated.

3.3 After-class: Consolidate the effectiveness of education

3.3.1Organize skills competitions to foster a sense of innovation

Organize cost estimation competitions and encourage students to use new technologies to build carbon emission visualization models. Set up the "Best Ecological Contribution Award" to reward groups that come up with innovative solutions in areas such as optimizing transportation routes for prefabricated components and reusing construction waste.

3.3.2 Establish a feedback mechanism to optimize instructional design

Establish ideological and political literacy growth files to record students' performance in dimensions such as green awareness and professional ethics. Collect feedback on "the most touching ideological and political teaching links" through Wenjuanxing, conduct a correlation analysis of teaching effects, and continuously improve teaching strategies.

4. CONCLUSION

In the context of the "dual carbon" strategy leading the transformation and upgrading of the construction industry, integrating ideological and political education into the "Prefabricated Building Engineering Cost" course is not only an inevitable requirement for fulfilling the fundamental task of fostering virtue and nurturing talent, but also an important way to cultivate new talents in the construction industry. By constructing a three-stage education model of "pre-class cognitive foundation - in-class value internalization - post-class practical elevation", the ecological view of green development, the craftsman view of striving for excellence, and the professional view of abiding by laws and regulations are organically integrated into professional teaching, effectively enhancing students' professional identity and social responsibility.

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Study of the Effect of Oxcarbazepine Combined with Topiramate in Treating Epilepsy

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Abstract: Objective: To investigate the therapeutic effect of oxcarbamazepine and topiramate in patients with epilepsy. Methods: select hospital 50 cases of epilepsy, according to the random method is divided into control group and observation group, 25 cases each, study the combination of oxcarbazine and topiramate epilepsy effect, the clinical effect of the control group and observation group including headache, gastrointestinal reaction, rash, motor decline, confusion, and statistical analysis of the two groups after treatment score. Results: the control group was treated with oxcarbazepine, and the observation group received topiramate according to the control group, and the observation group was better than the control group. Conclusion: the combination of oxcarbazepine and topiramate can significantly improve the treatment effect of patients with epilepsy, improve the quality of life, and reduce the risk of adverse effects.
Key words: Oxcarbazepine; Topiramate; Epilepsy; Combination Therapy

1. INTRODUCTION

Epilepsy refers to a sudden, transient, and recurrent functional disorder of the brain, characterised by brief episodes, stereotyped patterns, intermittent occurrences, and the potential for repeated seizures. Recurrence can lead to severe impairment of consciousness, as well as symptoms such as dizziness, headaches, rashes, gastrointestinal reactions, fatigue, and confusion. In severe cases, it can significantly impact daily life and work [1-2]. Currently, drug therapy is the primary treatment in clinical practice. Among these, the combination of oxcarbazepine and topiramate is an effective treatment for epilepsy. However, there is currently no single drug available in clinical practice that can safely and effectively treat epilepsy with minimal adverse reactions. If only one antiepileptic drug is used, treatment efficacy is poor and the treatment duration is prolonged. Once treatment exceeds 3–5 years, the patient's language and cognitive abilities may be severely impaired, and it may also affect other tissues and organs in the body, such as reduced kidney function. Therefore, it is recommended that patients gradually reduce the dosage or discontinue the medication after maintaining treatment for 1–2 years.

The combination of oxcarbazepine and topiramate demonstrates significant efficacy and high safety in treating epilepsy and has gained widespread clinical application. This combination therapy regimen has been recommended by numerous international authoritative guidelines and expert consensuses and has become a first-line treatment for epilepsy [3-4]. This regimen enhances the efficacy of antiepileptic therapy, improves patient treatment adherence, and further enhances treatment outcomes. Therefore, the combination of oxcarbazepine and topiramate for the treatment of epilepsy holds significant clinical importance.

2. RESEARCH METHODS

2.1 Study Population

The study population for this thesis consists of 50 epilepsy patients from a certain hospital. Based on these 50 epilepsy patients, a group comparison was conducted to evaluate the efficacy of oxcarbazepine monotherapy versus oxcarbazepine combined with topiramate in the treatment of epilepsy.

2.2 Observation Criteria

2.2.1 Effective patients: Patients whose seizure frequency decreased by 49% to 75% within six months of treatment were

considered effective; ineffective patients: Patients whose seizure frequency decreased by less than 49% within six months of treatment were considered ineffective. Overall effectiveness rate = (effective patients/total number of patients) × 100%.

2.2.2The number of seizures and seizure symptoms in the control group and observation group, including headaches, gastrointestinal reactions, rashes, impaired motor function, and confusion, were assessed using a scoring system, with one point per symptom. Lower scores indicate better treatment outcomes.

2.2.3Qualitative data were expressed as percentages, and quantitative data as mean ± standard deviation ($x \pm s$). A P-value < 0.05 indicated a significant difference between the two groups.

2.3 Research Methods

Fifty epilepsy patients were randomly divided into a control group and an observation group, with 25 patients in each group. In the control group, there were 16 male epilepsy patients and 9 female epilepsy patients, aged between 21 and 60 years old, with an average age of 39 years old and an average seizure frequency of 90%. In the observation group, there were 10 male epilepsy patients and 15 female epilepsy patients, aged between 20 and 62 years, with an average age of 40 years and an average epilepsy seizure frequency of 87%. After statistical analysis, we found no significant differences between the two groups in terms of age, gender, and other general characteristics.

The control group received treatment with oxcarbazepine, while the observation group received treatment with topiramate in addition to the control group's regimen. We compared the frequency of epileptic seizures and adverse reactions before and after treatment between the two groups. Adverse reactions included headaches, gastrointestinal reactions, rashes, impaired motor function, and confusion, among others, and we statistically analysed the scores of both groups after treatment.

Patients in both the control and observation groups underwent multiple tests, including blood and urine routine tests, liver and kidney function tests, etc. Patients in the control group received oxcarbazepine treatment, with an initial dose of 600 mg daily, divided into two doses. the dose will be gradually increased weekly, with each increase not exceeding 600 mg, ultimately maintaining a dose of 600 mg to 2400 mg daily. Patients in the observation group will receive additional treatment with topiramate in addition to the treatment in the control group. the initial dose is 25 mg/day, divided into two oral doses, with each subsequent increase of 25–25 mg/day, resulting in a maintenance dose range of 25–200 mg/day. Both the control and observation groups will continue treatment for over six months.

3. CLINICAL EFFICACY

3.1 Clinical efficacy

There was no significant difference in the average number of epileptic seizures between the two groups before treatment and one month after treatment (P>0.05); six months after treatment, the average seizure rate in the observation group (100%) was significantly better than that in the control group (76%), and there was a significant difference between the two groups (P<0.05).

Table 1 Comparison of mean number of seizures before and after treatment between the control group and the observation group

groups	Pre-treatment	Post-treatment
Control group(25)	90%	76%
Observation group(25)	87%	100%
P	0.147	0.013

In the control group, 19 patients achieved therapeutic effects, while 6 patients failed to achieve the expected therapeutic effects. Therefore, the overall efficacy rate of the control group reached 76%. However, in the observation group, all 25 patients responded successfully to the treatment, with no cases of ineffectiveness, resulting in a total efficacy rate of 100% in the observation group. Clearly, the therapeutic effects of the observation group were significantly superior to those of the control group, with a statistically significant difference (P<0.05).

The control group reported 4 cases of headache, 4 cases of gastrointestinal reactions, 5 cases of rash, 4 cases of motor function impairment, and 4 cases of confusion. the incidence rate of adverse reactions in the

control group was 36% (9/25). Among these, 1 patient experienced headache, 1 patient experienced motor function impairment, 1 patient experienced confusion, 1 patient concurrently experienced headache, gastrointestinal reactions, and rash, 1 patient concurrently experienced headache, rash, motor function impairment, 1 patient with headache, motor function impairment, and confusion, 1 patient with gastrointestinal reactions, rash, and motor function impairment, and 2 patients with gastrointestinal reactions, rash, and confusion. the incidence of adverse reactions in the observation group was significantly lower than that in the control group, with a statistically significant difference ($P < 0.05$).

Table 2 Comparison of treatment effects between the control group and the observation group

groups	Effective patients (persons)	Invalid patients (persons))	Overall effectiveness rate (%)
Control group(25)	19	6	76
Observation group(25)	25	0	100
P	0.007		

Table 3 Number of adverse reactions in the control group and observation group

groups	Dizziness and headache (times)	Gastrointestinal reactions (times)	Rash (times)Decreased motor function (times)	Fuzzy consciousness (times)	Rating (points)	
Control group(25)	4	4	5	4	4	21
Observation group(25)	2	1	1	1	0	2
P	0.011					

3.2 Discussion

The results of this study show that the overall efficacy of the control group using oxcarbazepine alone was inferior to that of the group using oxcarbazepine in combination with other medications. In the observation group, the efficacy of the oxcarbazepine plus topiramate combination was very significant overall. the clinical manifestations of epileptic seizures are caused by a variety of factors, and symptoms can vary significantly between individuals. Therefore, it is essential to seek medical attention immediately after the onset of symptoms. Through diagnostic examinations, the progression of the condition can be confirmed, and it can be properly classified, enabling effective control of the condition and minimising the risk of adverse clinical outcomes, thereby improving prognosis.

Oxcarbazepine and topiramate are currently the two most commonly used antiepileptic drugs in clinical practice. They effectively alleviate epilepsy symptoms, reduce seizure frequency, mitigate symptom severity, and protect the brain. However, single-drug therapy has limitations, and combination therapy is necessary to enhance efficacy [5-6]. the application of oxcarbazepine achieves its antiepileptic effect by selectively inhibiting cortical activity, blocking voltage-dependent sodium channels in brain cells, and reducing the size of epileptic foci. Meanwhile, topiramate demonstrates significant improvements in mood and antiepileptic effects following treatment. Therefore, the combined use of these two drugs can play a positive role, effectively inhibiting disease progression, improving seizure control efficiency, and stabilising the patient's physical condition. However, when using combined therapy, it is necessary to adjust the dosage of topiramate appropriately to reduce the occurrence of side effects and achieve the goal of sustained treatment. It is worth noting

that topiramate should be started at the minimum dose and gradually increased until the maximum effect is achieved.

4. CONCLUSION

The primary population at risk for epilepsy includes individuals with central nervous system damage, younger individuals, and those with a family history of the condition. After onset, the disease can cause damage to the central nervous system, leading to recurrent seizures. Oxcarbazepine and topiramate are commonly used drugs for treating epilepsy in clinical practice. Their mechanism of action primarily involves regulating the excitability threshold of neurons and brain tissue in the central nervous system. They are rarely administered as monotherapy and are typically given at low doses, with adjustments made based on efficacy and patient tolerance [7-9]. After 1–2 years, the dosage is gradually reduced until discontinued. the combination of topiramate and oxcarbazepine can fully utilise the limited pharmacokinetics and bioavailability of topiramate's monosulphate derivative, producing a synergistic effect. This study found that the combination of oxcarbazepine and topiramate effectively reduces drug side effects, alleviates pain and seizures in patients, and has a significant therapeutic effect on epilepsy patients, improving their quality of life and reducing adverse reactions. In summary, the efficacy of oxcarbazepine combined with topiramate in treating epilepsy is quite evident.

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The Research on the Index System and Evaluation Analysis of College Students' Innovation and Entrepreneurship Ability Under the Context of Independent Knowledge System

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Abstract: With the development of the global economy and the progress of science and technology, innovation has become the core element of national competitiveness. Colleges and universities, as important components of the national innovation system, bear the important mission of cultivating innovative talents and promoting technological innovation. This article systematically sorts out the indicator system of innovation and entrepreneurship capabilities in universities in the context of independent knowledge system, and evaluates and analyzes it, aiming to provide reference and inspiration for universities to enhance their innovation and entrepreneurship capabilities.

Keywords: Independent Knowledge System; College Students' Innovation and Entrepreneurship Ability; Index System; Evaluation and Analysis

1. INTRODUCTION

In the context of economic globalization and rapid development of science and technology, innovation has become the core element to measure national competitiveness. Colleges and universities, as important components of the national innovation system, are responsible for cultivating innovative talents and promoting technological innovation. In recent years, the Chinese government has attached great importance to the cultivation and improvement of college students' innovation and entrepreneurship ability, and has issued a series of policy documents, such as "Guiding Opinions on Deepening the Comprehensive Reform of Higher Education" and "National Medium and Long-term Education Reform and Development Plan (2010-2020)", which clearly put forward to strengthen the support for innovation and entrepreneurship education in colleges and universities and improve the quality of innovation and entrepreneurship talents. However, the cultivation of college students' innovation and entrepreneurship ability still faces many challenges, such as unscientific and unreasonable training plans and imperfect evaluation systems. Therefore, in the context of independent knowledge system, this study systematically sorts out the indicator system of innovation and entrepreneurship ability in universities, and evaluates and analyzes it, in order to provide reference and inspiration for universities to enhance their innovation and entrepreneurship ability.

2. INDEPENDENT KNOWLEDGE SYSTEM AND INNOVATION AND ENTREPRENEURSHIP CAPABILITY OF UNIVERSITIES

The connotation of independent knowledge system refers to a knowledge system with independent intellectual property rights and innovation capabilities, characterized by localization and integration of international advanced experience in a specific field. In innovation and entrepreneurship education in universities, building an independent knowledge system is the foundation for enhancing students' innovation ability. the construction of an independent knowledge system requires full consideration of local culture, social needs, and disciplinary

characteristics, while drawing on international advanced.

The connotation of innovation and entrepreneurship ability in universities refers to the comprehensive ability of universities to cultivate and enhance students' innovative spirit and entrepreneurial ability through innovative thinking and methods in education and teaching, scientific research, social services, and other aspects. the improvement of innovation and entrepreneurship capabilities in universities not only requires a scientific and reasonable training plan, but also a sound evaluation system and effective implementation strategies.

3. CONSTRUCTION OF INDEX SYSTEM FOR INNOVATION AND ENTREPRENEURSHIP CAPABILITY IN HIGHER EDUCATION INSTITUTIONS

The dimensions of the indicator system for innovation and entrepreneurship capability in universities should cover multiple dimensions such as knowledge, skills, attitudes, and behaviors. Specific indicators include mastery of professional knowledge, innovative thinking and ability, practical operation ability, teamwork and leadership, sense of social responsibility, and international perspective. These indicators not only reflect various aspects of students' innovation and entrepreneurship abilities, but also provide clear directions for the implementation of innovation and entrepreneurship education in universities.

3.1 Principles for constructing indicator system

3.1.1Combining scientificity and measurability: the scientificity of evaluation is reflected in the rationality of evaluation indicators, the scientificity of evaluation methods, and the reliability of evaluation results. Measurability is reflected in the concretization and quantification of evaluation indicators, as well as the clarity of evaluation results. Through this evaluation method, we can comprehensively and accurately understand the cultivation of innovation and entrepreneurship capabilities in universities, providing a basis for improving training plans.

3.1.2Diversification and dynamism: the evaluation system should shift from a single exam score to process evaluation, ability evaluation, and comprehensive evaluation. Emphasize the combination of qualitative and quantitative evaluation, as well as internal and external evaluation, to comprehensively evaluate the effectiveness of innovation and entrepreneurship education in universities.

4. EVALUATION AND ANALYSIS OF INNOVATION AND ENTREPRENEURSHIP CAPABILITIES IN UNIVERSITIES

Evaluation method: (1) Questionnaire survey: By designing a questionnaire, collect opinions and suggestions from internal and external stakeholders of universities to understand the current situation and problems of innovation and entrepreneurship capabilities in universities. (2) Data mining technology: Collect and integrate various types of data from universities, such as scientific research achievements, student employment situation, school enterprise cooperation situation, etc., use data mining technology for analysis, and reveal the characteristics and laws of innovation and entrepreneurship ability of universities. (3) Comprehensive evaluation method: A comprehensive evaluation method combining quantitative and qualitative methods is adopted to establish an evaluation index system, evaluate the innovation and entrepreneurship capabilities of universities, and provide specific evaluation results and suggestions.

The analysis of evaluation results reveals the current status and existing problems of innovation and entrepreneurship capabilities in universities through the evaluation and analysis of their innovation and entrepreneurship capabilities. For example, some universities do not have a scientific and reasonable curriculum for innovation and entrepreneurship, and the proportion of practical activities is relatively low; the evaluation system for innovation and entrepreneurship capabilities is not perfect enough, lacking scientific and reasonable evaluation indicators and methods; the cooperation between universities, enterprises, governments, etc. is not close enough, and students lack practical and innovative platforms. These issues seriously affect the improvement of innovation and

entrepreneurship capabilities in universities and require high attention.

5. STRATEGIES FOR ENHANCING THE INNOVATION AND ENTREPRENEURSHIP CAPABILITIES OF UNIVERSITIES

Universities should develop a scientific and reasonable plan for cultivating innovation and entrepreneurship abilities, including curriculum design, practical activities, and innovation ability development. the curriculum should cover both theoretical and practical courses to cultivate students' basic knowledge and practical abilities; the practical process should include experiments, internships, innovation and entrepreneurship practices, etc., to cultivate students' hands-on and innovative abilities; the cultivation of innovative ability should include aspects such as innovative thinking, innovative methods, and innovative practices, in order to cultivate students' innovative consciousness and ability.

Strengthening the construction of the teaching staff, universities should introduce and cultivate a group of teachers with innovative spirit and entrepreneurial practice experience to provide students with better innovation and entrepreneurship education. Teachers are the key to innovation and entrepreneurship education in universities. Only with a high-quality teaching team can we provide students with high-quality innovation and entrepreneurship education.

To improve the evaluation system, universities should establish a scientific and reasonable evaluation system for innovation and entrepreneurship capabilities, including process evaluation and outcome evaluation. Process evaluation mainly focuses on students' performance in the course learning process, such as participation, teamwork, innovative thinking, etc; the evaluation of results mainly focuses on students' learning outcomes, such as course papers, innovation and entrepreneurship projects, etc. Through this evaluation method, students' innovation and entrepreneurship abilities can be comprehensively evaluated, providing a basis for improving the training plan.

Strengthening school enterprise cooperation: Universities should strengthen cooperation with enterprises, governments, etc., and provide students with a platform for practice and innovation. Through school enterprise cooperation, students can apply theoretical knowledge to practice and improve their innovation and entrepreneurship abilities; At the same time, enterprises can also provide practical bases and project support for universities, promoting the development of innovation and entrepreneurship education in universities.

6. CONCLUSION

In the context of an independent knowledge system, the enhancement of innovation and entrepreneurship capabilities in universities is of great significance for the improvement of national innovation capabilities and competitiveness. By constructing a scientifically reasonable index system for innovation and entrepreneurship capabilities and evaluating and analyzing it, reference and inspiration can be provided for universities to enhance their innovation and entrepreneurship capabilities. However, the improvement of innovation and entrepreneurship capabilities in universities still faces many challenges, such as insufficiently scientific and reasonable training plans, and inadequate evaluation systems. Therefore, universities should develop scientific and reasonable training plans, strengthen the construction of teaching staff, improve the evaluation system, and enhance school enterprise cooperation to promote the improvement of students' innovation and entrepreneurship abilities.

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Enhancing the Mental Health Education Capabilities of Vocational College Counselors

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Abstract: Mental health education is a crucial aspect of the work of counselors in vocational colleges, and the effectiveness of this work is directly related to the quality of talent cultivation in these institutions. Vocational college counselors face challenges and problems in mental health education, such as insufficient knowledge reserves, weak application abilities of psychological counseling methods, a lack of awareness of psychological prevention education, and an imperfect mental health monitoring system. To address these issues, this paper proposes countermeasures to enhance counselors' mental health education capabilities, including strengthening theoretical learning related to mental health education, conducting psychological counseling skills training, implementing mental health prevention education programs, establishing a student mental health monitoring mechanism, promoting the coordinated management of counselors' mental health education, and improving the assessment mechanism for counselors' mental health education. These measures provide a theoretical basis and practical reference for vocational colleges to strengthen students' mental health education.

Keywords: Vocational colleges; Counselors; Mental health education

1. INTRODUCTIONS

With the rapid development and transformation of society, students in vocational colleges are facing increasingly complex psychological pressures and challenges. Counselors, as important guides on students' growth paths, play a crucial role in students' mental health education. They not only need to pay attention to students' academic progress but also care about their mental health and all - round development. However, to effectively fulfill this responsibility, counselors' own mental health education capabilities are of vital importance. Currently, vocational college counselors encounter numerous challenges and problems in mental health education, such as insufficient professional knowledge and skills, and high work pressure. This study aims to deeply understand the current situation of vocational college counselors' mental health education capabilities through practice and exploration, analyze existing problems and challenges, and propose practical strategies and methods for improvement. It is hoped that this study can provide useful references for vocational college counselors, enabling them to better assume the responsibility of students' mental health education and promote students' all - round development and healthy growth.

2. THE NECESSITY OF ENHANCING THE MENTAL HEALTH EDUCATION CAPABILITIES OF VOCATIONAL COLLEGE COUNSELORS

2.1 Promoting Students' Healthy Growth

When counselors carry out mental health education, they can help students establish correct outlooks on life, the world, and values, and cultivate good psychological qualities. In the face of confusion and pressure during growth, counselors can help students relieve negative emotions and prevent the occurrence of psychological problems through psychological counseling, which is of great significance for students' healthy growth. Specifically, counselors can teach students methods to correctly understand themselves, manage emotions, and maintain an optimistic attitude through lectures, workshops, group counseling, and other forms. This can improve students' adaptability to the environment and interpersonal communication skills, help them

build self - esteem and self - confidence, and eliminate negative emotions. Only when counselors have systematic knowledge and methods of mental health education can they better guide students to grow healthily. [1]

2.2 Effectively Responding To Psychological Crisis Incidents

In recent years, the number of psychological problems such as depression and anxiety among students in vocational colleges has been on the rise. By carrying out preventive mental health education, counselors can help students understand themselves, manage emotions, and relieve stress, thereby reducing the incidence of psychological problems. Specifically, counselors should actively conduct psychological adjustment training to enhance students' ability to identify and cope with stress. They should teach students some skills to soothe emotions, such as deep - breathing relaxation and guided imagery. They should also actively use psychological group training activities and sports to help students release mental stress and improve their teamwork and organizational communication abilities. In addition, preventive education should be carried out for problems such as Internet addiction and love - related distress. Only by improving counselors' knowledge level of psychological counseling can the pertinence and effectiveness of mental health education be enhanced.

2.3 improving Students' Vocational Competitiveness And Professional Literacy

Psychological quality is one of the important factors determining students' vocational competitiveness. Through mental health education, counselors can enhance students' self - confidence, stress resistance, team spirit, etc., help students build a good mentality, and improve their employability. Specifically, counselors should attach great importance to the development of college students' career planning and employment and entrepreneurship guidance. They should help students set ideal goals, cultivate their good emotion management ability, and enhance their stress resistance in the face of employment. Role - playing and scenario simulation can be used to improve students' teamwork and communication skills. the cultivation of mental health literacy helps to build the soft power in an individual's vocational competitiveness. When a person has a healthy psychological state, they can cope with difficulties on their own and solve problems in a rational and win - win way. This positive energy helps to enhance team cohesion and cooperation, and improve work efficiency.

2.4 Promoting Campus Harmony And Stability

Students' mental health directly affects campus harmony and stability. By actively carrying out a variety of mental health education work, counselors can help students adjust their interpersonal relationships, establish correct values, and resolve conflicts to maintain stability. Specifically, counselors should carry out interpersonal communication training to teach students to adjust inappropriate interpersonal cognition and attitudes and cultivate their interpersonal communication abilities. Moral education should also be carried out to help students establish correct values. Through various mental health education theme activities, the effect of educating people through practice can be achieved. Only when counselors master the knowledge and methods of interpersonal relationship adjustment and moral education can they improve students' interpersonal communication and moral cultivation, thereby promoting campus harmony.

3. PROBLEMS IN THE MENTAL HEALTH EDUCATION CAPABILITIES OF VOCATIONAL COLLEGE COUNSELORS

3.1 Insufficient Knowledge Reserves In Mental Health Education

Currently, many vocational college counselors have weak professional knowledge in psychology and insufficient systematic theoretical knowledge reserves in mental health education. This is specifically manifested in an incomplete understanding of the growth laws and psychological development characteristics of adolescents, and an inaccurate analysis of the symptoms and causes of various psychological diseases. Counselors are the main force in education and management in vocational colleges, and they come from various majors before engaging in counseling work. Most counselors

have not systematically studied professional knowledge in mental health education. Mental health education is highly comprehensive, scientific, and professional, covering multiple aspects such as psychology, pedagogy, and sociology. [2] the unsystematic and unscientific knowledge structure leads to blind spots in counselors' mental health education work, making it difficult for them to accurately judge and effectively intervene in students' psychological problems.

3.2 Weak Application Abilities Of Psychological Counseling Methods

At present, many vocational college counselors have weak application abilities of psychological counseling methods. This is specifically manifested as: the inability to establish good communication channels with students, resulting in unclear information transmission and difficulty in accurately identifying students' psychological problems and needs; when facing students' psychological problems, the solutions are single, and they cannot flexibly respond to different situations or formulate appropriate counseling plans according to individual differences; they are not proficient in applying various psychological counseling techniques, such as supportive conversation, suggestion, and role - playing; they have poor self - regulation ability, and their own emotions are easily affected by students, unable to remain calm and objective; it is difficult to establish trust and a good counseling relationship with students, and they do not respond adequately to students' emotional needs, unable to provide effective support and help. All these factors restrict the effectiveness of counselors' mental health education work.

3.3 The Need to Strengthen the Awareness of Psychological Prevention Education

Currently, vocational college counselors pay more attention to therapeutic counseling for students with existing psychological problems, but do not attach enough importance to preventive mental health education. This is specifically manifested as: not regarding preventive mental health education as routine work, and the investigation of potential mental health problems is not scientific and specific; not paying enough attention to signs that may trigger psychological problems, and lacking a warning awareness.

4. MEASURES TO ENHANCE THE MENTAL HEALTH EDUCATION CAPABILITIES OF VOCATIONAL COLLEGE COUNSELORS

4.1 Strengthening Theoretical Learning Related To Mental Health Education

Counselors should earnestly study psychological theories such as developmental psychology, educational psychology, and adolescent psychology. These theoretical knowledge can enable counselors to deeply understand the growth laws and psychological characteristics of adolescents and establish judgment criteria for the psychological states of students at different age stages, which is the basis for carrying out mental health education. Counselors can objectively distinguish the types and severity of students' psychological problems based on their mastered professional psychological knowledge, implement crisis intervention in advance, and learn to use psychological counseling methods to guide students. Counselors should actively learn different types of psychological counseling techniques, such as supportive conversation, personality analysis, and behavior therapy, to enrich their psychological counseling skills. Only in this way can counselors accurately judge students' mental health status and use appropriate methods to carry out targeted education. [3] Systematic and comprehensive learning of psychology - related knowledge is the key to enhancing counselors' mental health education capabilities.

4.2 Conducting Psychological Counseling Skills Training

Schools should regularly organize various forms of training, including content such as psychological counseling, psychological assessment, and interpersonal communication. Counselors can learn the processes and skills of psychological counseling online. Senior counselors can demonstrate the use of psychological counseling techniques such as supportive communication and interpretation techniques on the spot, and organize counselors to analyze typical psychological counseling cases to clarify the actual operation steps. Simulated scenarios can also be set up to allow counselors to practice how to carry out cognitive - behavioral therapy. These different forms of skills training not only teach

counseling techniques and methods for solving students' psychological problems but also enable counselors to master these techniques proficiently through personal simulation exercises, thereby truly enhancing their mental health education counseling capabilities. Schools should continuously organize skills training to enable counselors to make breakthroughs in key skills such as supportive communication, interpretation techniques, and cognitive - behavioral therapy, improve their ability to provide targeted counseling to students, and better help students achieve a healthy psychology.

4.3 implementing Mental Health Prevention Education Programs

To carry out regular mental health prevention education, schools need to incorporate it into counselors' daily work and form a complete working mechanism. Various forms of mental health education activities can be regularly carried out for students in different grades to teach them scientific methods of emotion regulation and stress coping and prevent the occurrence of psychological problems. Lectures can be used to invite experts to popularize mental health knowledge for students, and counselors can be organized to lead students in group counseling activities for adjustment ability training. At important nodes such as the beginning of each semester, final exams, and graduation season, schools should organize mental health assessments so that counselors can timely detect students' psychological problems. For student groups with more problems such as Internet addiction and love - related distress, counselors should design targeted special counseling programs. Through diversified preventive education, the majority of students can benefit. Only by regarding preventive mental health education as a long - term task for counselors and forming a complete working mechanism can full - scale and all - round mental health prevention education be achieved, and the occurrence of students' psychological problems can be reduced from the source.

5. CONCLUSION

Counselors' mental health education competence is vital for student development and campus stability. By addressing existing issues with proposed strategies, vocational colleges can enhance mental health education, fulfilling the mission of nurturing well - rounded individuals.

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Research on the Innovation of Campus Football Youth Training System and Pathways for Youth Football Talent Development under the "Integration of Sports and Education" Policy

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Abstract: The in-depth implementation of the "Integration of Sports and Education" policy highlights the innovation of campus football youth training systems and the cultivation of youth football talent as key issues for enhancing football standards in China. This study employs literature review and systematic analysis to explore the current status, challenges, and innovative directions of the campus football youth training system under this policy, aiming to establish a scientifically efficient pathway for youth football talent development. By reviewing related theories and practices domestically and internationally, and analyzing the actual development of campus football in China, the study identifies deficiencies in resource integration, curriculum setting, and talent selection and training mechanisms. It finds that effective implementation of the "Integration of Sports and Education" policy requires breaking down barriers between sports and education departments, establishing collaborative education mechanisms, optimizing training curricula for an organic combination of football training and cultural education, and improving talent selection and training mechanisms. A multi-faceted competition platform should also be developed to enhance youth football potential. Consequently, a strategic innovation pathway for the campus football youth training system is proposed, emphasizing policy collaboration, curriculum innovation, resource integration, and mechanism optimization, providing theoretical and practical guidance for fostering youth football talent and promoting the sustainable development of football in China.

Keywords: Integration of Sports and Education; Campus Football; Youth Training System; Youth Football; Talent Development Pathways

1. INTRODUCTION

1.1 Research Background and Significance

As part of building a strong sports nation, football, the world's most influential sport, serves as a critical indicator of a country's overall sporting strength. China faces a talent shortage and a weak youth training system in football, with youth football participation below 0.3% of the total population, compared to Germany's 11%. In this context, the "Integration of Sports and Education" policy is pivotal for addressing youth football training challenges. The 2020 joint guidelines from the National Sports Administration and the Ministry of Education emphasize enhancing school sports and improving youth sports event systems, providing policy direction for campus football training systems. The campus football youth training system is essential for bridging basic education and professional football talent development. Its innovative development is strategically significant for improving youth football standards and establishing a solid foundation for China's football talent. Optimizing the training system through sports-education integration not only resolves the disconnection between cultural education and athletic training but also leverages educational resources to expand the football talent pool. High-quality campus football training fosters

teamwork and resilience in youth, aligning with contemporary educational philosophies.

1.2 Review of Domestic and International Research

Internationally, research on campus football youth training systems has matured, with countries like Germany employing a dual-track model integrating football training within basic education through community club resources, and Japan establishing a four-tier league system that boosts student engagement. These models have markedly improved youth football talent quality.

Domestically, research focuses on implementing sports-education integration policies and the challenges in campus football development. Scholars often identify uneven resource distribution, insufficient faculty, and an inadequate competition framework. Some studies suggest establishing collaborative mechanisms among government, schools, and society, and introducing technological training methods. However, existing studies frequently analyze from a single dimension, lacking systematic exploration of policy effectiveness and dynamic optimization mechanisms in youth training systems.

1.3 Research Objectives and Methods

This research aims to analyze the operational logic of campus football youth training systems under the "Integration of Sports and Education" policy, revealing existing issues and proposing innovative pathways to provide theoretical and practical support for developing a unique Chinese youth football talent cultivation model. The research utilizes a multi-method strategy: literature review to compile relevant policies and academic achievements; survey research to gather data on current training implementation; case studies for comparative analysis across regions; and systematic analysis to construct an optimization model for the training system.

2. THEORETICAL FOUNDATION OF THE "INTEGRATION OF SPORTS AND EDUCATION" POLICY AND CAMPUS FOOTBALL YOUTH TRAINING SYSTEM

2.1 Connotation and Development of the "Integration of Sports and Education" Policy

The "Integration of Sports and Education" policy has evolved from "sports-education combination" to an integrated approach. Early models focused on cultivating sports-specialized students but faced issues of overlapping responsibilities and resource fragmentation. The current model emphasizes holistic youth development and the systematic integration of sports education resources. Key aspects include: aligning sports education goals with ethical education; integrating resources from schools, sports departments, and social organizations; and incorporating sports training into daily educational practices. Recent national policies promote deeper integration, setting goals for youth to master 1-2 sports skills by 2025 and outlining specific requirements for campus football training systems, marking a shift from advocacy to practical implementation.

2.2 Concept and Components of the Campus Football Youth Training System

The campus football youth training system centers on schools and covers curriculum delivery, training, competitions, faculty development, and support mechanisms. Its functions encompass promoting football, selecting talent, enhancing competitive levels, and realizing educational values. Key components include a curriculum system for foundational teaching and specialized training, a diverse faculty of teachers and coaches, a competition framework with various levels of tournaments, and a support system involving policy backing and resource allocation.

The system must remain open and dynamic, continuously optimizing in response to policy directions, social needs, and youth developmental trends.

3. CURRENT STATUS OF THE CAMPUS FOOTBALL YOUTH TRAINING SYSTEM UNDER THE "INTEGRATION OF SPORTS AND EDUCATION" POLICY

3.1 Development History of the Campus Football Youth Training System

Established in the 1980s, the campus football youth training system has progressed through pilot exploration, comprehensive promotion, and deep reform phases, transitioning to a rapid development stage post-2015 with the issuance of the "Overall Plan for the Reform and Development of Chinese Football,"

increasing the number of specialized schools from 5,000 to 36,000. The implementation of the "Integration of Sports and Education" policy is steering the training system towards professionalization and systematic development.

3.2 Current Implementation of the Campus Football Youth Training System

Under policy guidance, significant achievements have been made, with increases in curriculum coverage and teacher training programs yielding over 100,000 trained football teachers. The competition framework has expanded to include 200,000 teams, engaging over five million students. Additionally, digital technologies are being applied in training contexts.

However, there are notable discrepancies in regional development, with 65% of specialized schools located in the eastern regions, while western provinces lag behind. Participation in high-level competitions remains low, with only 5% of campus football players advancing to provincial-level events.

4. ISSUES IN THE CAMPUS FOOTBALL YOUTH TRAINING SYSTEM UNDER THE "INTEGRATION OF SPORTS AND EDUCATION" POLICY

4.1 Resource Integration and Coordination Problems

There is ambiguity in resource allocation responsibilities between sports and education departments, with 73% of schools reporting ineffective communication regarding venue use and event organization. Corporate sponsorship is concentrated on premier events, leaving grassroots campus football with a funding gap of 42%. Furthermore, inter-school resource sharing mechanisms are lacking, hindering the mobility of quality faculty and training facilities.

4.2 Curriculum Setting and Teaching Quality Issues

The curriculum lacks scientific coherence, with overlapping content across educational stages. Traditional teaching methods dominate, with 68% of classes relying on demonstration, lacking personalized training plans. The professional qualifications of faculty vary greatly, and less than 30% hold advanced coaching certifications, failing to meet high-level training needs. Conflicts between cultural education and football training schedules further impede student development.

4.3 Talent Selection and Training Mechanism Issues

Current selection criteria overly emphasize athletic performance, neglecting comprehensive assessments of cultural literacy and psychological qualities. The pathways for student athletes to transition into professional clubs are narrow, with less than 0.1% achieving this, leading to low parental enthusiasm for youth training participation. The cultivation mechanism lacks coherence, failing to create a continuous pathway from elementary to university education, often leaving students without training opportunities post-admission.

5. INNOVATION PATHS FOR YOUTH FOOTBALL TRAINING SYSTEM UNDER THE "INTEGRATION OF SPORTS AND EDUCATION" POLICY

5.1 Strengthening Policy Coordination and Resource Integration

Under the "Integration of Sports and Education" framework, it is essential for sports and education departments to clarify their responsibilities within the youth football training system. Both parties should collaborate to develop detailed implementation guidelines, specifying venue usage rules. For example, during non-teaching hours, school facilities should be available for youth training activities organized by sports departments, which must communicate with schools beforehand to ensure proper venue maintenance. A joint task force should be established for event organization: the education department would coordinate student participation times to minimize academic disruption, while the sports department would oversee technical aspects such as referee selections and event regulations.

To enhance societal engagement in youth football training, the government could introduce tax incentives for companies sponsoring school football. For instance, a percentage of the sponsorship amount could be deductible from the company's taxable income. Additionally, establishing a football industry incubation platform would encourage social capital to develop related training

programs and equipment, providing policy consulting and marketing support to businesses, thereby broadening their involvement in school football.

Creating an inter-school resource-sharing network is critical. This platform would consolidate information on teaching staff across schools, including their football skills and teaching experience, allowing schools to book high-quality educators online for short-term teaching or training. It should also provide real-time updates on the availability of training facilities and equipment, facilitating inter-school borrowing and improving resource utilization efficiency.

5.2 Advancing Curriculum Innovation and Teaching Optimization

To establish a coherent youth football curriculum, it should be designed based on the physical and psychological development characteristics of adolescents and the learning patterns of football skills. For elementary schools, the focus should be on fostering interest in football, primarily through games and basic skills practices, such as "football relays" and "shooting competitions." In middle schools, the technical difficulty should increase, incorporating tactical training and teamwork exercises. High school programs should emphasize personalized development, offering specialized training based on students' strengths, such as shooting techniques for forwards or defensive awareness for defenders.

Innovative teaching methods, such as project-based learning, should be adopted. Teachers can set football-related tasks, like organizing a friendly match, requiring students to learn rules, tactics, and teamwork autonomously. Utilizing virtual reality (VR) technology could create realistic match scenarios for tactical simulation training, enhancing students' abilities to handle complex match situations. Research indicates that classes using project-based learning combined with VR technology see a 25% faster improvement in football skills compared to traditional teaching methods.

Enhancing coach training through regular national and provincial-level coaching camps, featuring renowned instructors, is essential. Training should cover advanced training concepts and scientific physical training methods. Establishing a special pathway for football teacher certification would integrate teaching achievements and team performance into evaluation criteria, motivating teachers to improve their professional skills. To address conflicts between academic and training schedules, schools could implement flexible timetables, reducing academic coursework during peak training periods while offering after-school tutoring to ensure a balance between academic learning and football training.

5.3 Improving Talent Selection and Development Mechanisms

A comprehensive evaluation standard for talent selection should be established, incorporating not only athletic performance but also academic achievement, learning ability, psychological resilience, and teamwork spirit. Academic scores could account for 30% of the total evaluation, assessed through regular academic tests; psychological resilience could be quantitatively evaluated using specialized psychological assessment tools; teamwork spirit would be assessed based on students' performances during training and competitions, evaluated collaboratively by coaches and peers.

Expanding talent transfer channels and enhancing collaboration between school football programs and professional clubs is vital. Professional clubs could establish talent selection bases at schools with distinctive football programs, regularly scouting promising athletes for their youth training teams. Moreover, promoting connections between school football programs and high-level university sports teams would encourage universities to adopt flexible admission policies for outstanding youth football players.

Establishing a talent development pathway that spans from elementary school through university is crucial. This would involve creating talent development records that document students' training and competitive data across different educational stages, ensuring seamless transitions and continuity in coaching plans. Strengthening inter-school communication and collaboration through regular joint training sessions and exchange competitions would promote continuous skill development among students.

6. CONCLUSION

This study provides an in-depth analysis of the youth football training system under the "Integration of Sports and Education" policy, highlighting its strategic significance in enhancing youth football performance and laying a solid foundation for China's football talent pool. A review of domestic and international research reveals shortcomings in areas such as policy implementation effectiveness and dynamic optimization of training systems. The analysis of the current state of youth football training identifies challenges in resource integration, collaborative mechanisms, curriculum design, teaching quality, and talent selection and development systems.

To address these issues, it is recommended to strengthen policy coordination and resource integration through clear delineation of departmental responsibilities, attracting social resources, and establishing inter-school resource-sharing platforms to optimize resource allocation; to advance curriculum innovation and teaching optimization by developing a scientific curriculum framework, innovating teaching methods, enhancing teacher qualifications, and resolving scheduling conflicts; and to improve talent selection and development mechanisms by establishing comprehensive evaluation standards, expanding transfer channels, and creating a coherent talent development pathway. These innovative paths aim to develop a youth football talent cultivation model with Chinese characteristics, providing theoretical and practical references for the advancement of the youth football training system.

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Research on Innovative Management Models for Green Behavior Cultivation of University Students Driven by the "Dual Carbon" Goals

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Abstract: In the context of the global push for "dual carbon" goals, universities, as crucial talent cultivation arenas, play a significant role in innovating management models for fostering students' green behavior, which is essential for promoting green development. This study employs literature review, questionnaire surveys, and systematic analysis to delineate relevant theories and practices regarding the management of students' green behavior in universities both domestically and internationally, ultimately constructing a model of influencing factors. By sampling students from multiple universities, data on their current green behaviors and influencing factors were collected, and structural equation modeling was utilized to analyze the mechanisms among these factors. Findings indicate that environmental awareness, campus atmosphere, institutional constraints, and educational guidance significantly influence the cultivation of green behavior among university students. Based on these results, innovative pathways for the management model of students' green behavior are proposed from perspectives of conceptual innovation, institutional optimization, educational system improvement, and incentive mechanism development, aiming to provide theoretical references and practical guidance for cultivating students' green behaviors and supporting the realization of "dual carbon" goals.

Keywords: Dual carbon goals; University students; Green behavior; Management model; Model innovation

1. INTRODUCTION

1.1 Research Background and Significance

Global climate change poses a significant challenge to sustainable development, with consensus on the need to reduce greenhouse gas emissions and achieve green transitions. China has proposed the "dual carbon" targets of reaching peak carbon emissions by 2030 and carbon neutrality by 2060, which represent strategic decisions for enabling comprehensive green transformation of the economy and society. Higher education, as a vital field for talent cultivation and knowledge innovation, bears an important responsibility in achieving these targets. Students in higher education, as the backbone of future societal development, play a critical role in cultivating green behaviors that not only enhance personal ecological literacy but also serve as a model for promoting low-carbon lifestyles and disseminating green development concepts throughout society.

With over 40 million students currently enrolled in Chinese universities, the combined energy consumption, resource use, and waste emissions of this group are substantial. Effectively guiding students to adopt green behaviors, such as reducing single-use items and improving energy efficiency, can lead to significant emission reductions on campus and promote low-carbon transitions across society through student networks. Researching innovative management models for cultivating green behavior under the "dual carbon" framework is not only a practical necessity for implementing national strategies but also a theoretical demand for enhancing environmental education systems and improving students' overall competencies, which is crucial for achieving high-quality development in higher education and advancing ecological civilization.

1.2 Review of Domestic and International Research

Internationally, research on green behavior cultivation has progressed well, focusing on

individual decision-making mechanisms and intervention strategies. The Theory of Planned Behavior (TPB) explains the formation of individual green behavior through dimensions such as behavioral attitudes, subjective norms, and perceived behavioral control. The Value-Belief-Norm (VBN) theory emphasizes the driving role of personal values in environmental behavior. In the context of higher education, U.S. universities have established sustainability offices and green campus certification systems, integrating low-carbon concepts into curricula and campus life; while the European Union has implemented the "European Campus Sustainability Initiative," promoting green behavior through student organizations and policy incentives. These studies are often based on established environmental education systems and policy contexts, focusing on empirical analysis and intervention effectiveness.

In contrast, domestic research primarily centers on environmental education and students' pro-environmental behaviors. Some scholars have found that while university students in China exhibit high levels of green awareness, there is a significant gap in behavior transformation, with only 38% consistently engaging in daily green practices such as waste sorting and energy conservation. Other studies have pointed out current management models' issues, such as a predominance of theoretical education over practical guidance and a singular approach to incentive mechanisms. However, there is insufficient systematic research on the cultivation of students' green behavior specifically under the "dual carbon" policy framework, particularly regarding innovative management pathways and the mechanisms of influencing factors.

2. CORE CONCEPTS AND THEORETICAL FOUNDATIONS

2.1 Definition of "Dual Carbon" Goals and Green Behavior

The "dual carbon" goals refer to achieving peak carbon emissions and carbon neutrality, with the former indicating the highest level of carbon dioxide emissions reached at a specific time, subsequently declining; while the latter involves offsetting carbon emissions through activities such as afforestation and energy conservation to achieve "zero emissions." These goals necessitate a comprehensive green transformation of production and lifestyle across society. Green behavior encompasses actions individuals take in daily life and work that follow principles of ecological protection to reduce resource consumption and environmental pollution, including resource conservation, waste sorting, and low-carbon commuting. The cultivation of green behavior among university students is a process of internalizing the concept of green development into value recognition and externalizing it into stable behavioral habits through education, institutional constraints, and environmental creation.

2.2 Theoretical Foundations

The Theory of Planned Behavior provides a framework for analyzing students' decision-making regarding green behavior, positing that behavioral intentions are influenced by attitudes toward the behavior, subjective norms, and perceived behavioral control. Positive attitudes toward green behavior (e.g., viewing low-carbon living as beneficial for the environment), demonstration of pro-environmental behaviors by significant others (subjective norms), and self-perceived capability to engage in green behavior (perceived behavioral control) all impact students' ultimate behavioral choices. Social Learning Theory emphasizes that individuals acquire new behaviors through observational learning, and universities can facilitate the acquisition of green behaviors through role modeling and the cultivation of campus culture. Institutional Economics Theory suggests that appropriate institutional arrangements (e.g., incentive policies, constraint mechanisms) can alter individuals' behavior cost-benefit expectations, promoting sustained green behavior. These theories provide various perspectives and theoretical support for innovating management models for cultivating green behavior among university students.

3. ANALYSIS OF CURRENT MANAGEMENT STATUS OF GREEN BEHAVIOR CULTIVATION AMONG UNIVERSITY STUDENTS

3.1 Current State of Green Behavior Among University Students

A sampling survey across 32 universities in China reveals that students demonstrate a strong understanding of green concepts, with 92% aware of the basic content of the "dual carbon" goals and 87% recognizing the importance of green behavior for environmental protection. However, significant disparities exist in behavioral practices: 65% of students conserve energy (e.g., turning off lights and saving water); only 43% accurately sort waste; and merely 31% prioritize public transportation or biking for low-carbon commuting. Further analysis indicated that engineering and science students excel in energy-saving technology knowledge but exhibit lower participation in daily green behaviors compared to their liberal arts counterparts. Additionally, upperclassmen face a decrease of 18% in consistent green behaviors due to academic pressures. This disconnect between awareness and behavior, along with differences among groups, reflects the complexity of cultivating green behaviors among university students and the urgency of optimizing management strategies.

3.2 Issues in Existing Management Models

Current management of students' green behavior cultivation in universities relies predominantly on traditional models, which exhibit several limitations. In terms of educational systems, environmental education courses are often offered as elective general studies with minimal credit weight (less than 3% of total credits), focusing heavily on theoretical knowledge without practical engagement, thereby hindering students' ability to translate knowledge into action. Regarding incentive mechanisms, only 27% of universities have established reward systems for green behavior, predominantly relying on honors certificates with a lack of material and spiritual incentives, which diminishes sustainable motivation. Additionally, collaboration among student affairs, logistics management, and teaching units is fragmented, lacking unified planning and resource integration, leading to inefficiencies in management. These issues render the current management models inadequate in meeting the high demands set by the "dual carbon" goals for cultivating students' green behaviors.

4. ANALYSIS OF INFLUENCING FACTORS IN MANAGEMENT MODELS FOR GREEN BEHAVIOR CULTIVATION DRIVEN BY "DUAL CARBON" GOALS

4.1 Identification of Influencing Factors

Utilizing the Delphi method and grounded theory, key factors influencing the management models for cultivating green behavior among university students were identified through multiple rounds of interviews and surveys with university administrators, faculty, students, and environmental experts. Individual-level factors include environmental values, behavioral habits, and self-efficacy; school-level factors encompass curriculum systems, incentive mechanisms, and campus cultural atmosphere; and societal factors involve policy guidance, media promotion, and family environment influences. Notably, students' environmental values accounted for 62% of the variance in green behavior cultivation, highlighting the central role of value recognition in behavior shaping. The effectiveness score of school incentive mechanisms was only 4.2 (out of 10), indicating insufficient guidance from existing systems on student behavior. The weight coefficient of policy guidance was 0.35, reflecting the significant driving force of national "dual carbon" policies in transforming university management models.

4.2 Mechanisms of Influencing Factors

Individual factors influence the cultivation of green behavior through psychological cognition and decision-making pathways. Environmental values serve as deep-level drivers, moderating students' attitudes and choices regarding green behavior; self-efficacy directly affects students' confidence and sustainability in practicing green behaviors. School-level factors constitute the direct environment for behavior cultivation, where the curriculum system enhances students' green awareness through knowledge transfer, incentive mechanisms alter behavior cost-benefit expectations, and campus cultural atmosphere creates behavioral pressure and motivation through group norms and role models. Social-level factors exert indirect influences, with national "dual carbon" policies being disseminated to universities

through educational authorities, driving management model transformations; media promotion and family environments shape students' willingness to engage in green behaviors through information dissemination and emotional support. The interplay and synergetic effects of these factors collectively shape the operational logic of management models for cultivating green behavior among university students.

5. INNOVATIVE PRINCIPLES AND APPROACHES FOR CULTIVATING GREEN BEHAVIOR AMONG UNIVERSITY STUDENTS UNDER THE CARBON NEUTRALITY GOAL

5.1 Innovative Principles

The innovation of management models for cultivating green behavior among university students should adhere to the principle of systematization. This complex process involves individual cognition, educational management, and social environmental influences. At the individual level, students' environmental values, behavioral habits, and self-efficacy intertwine to affect their green behavior decisions. At the institutional level, the curriculum, incentive systems, and campus culture work synergistically to shape students' green behavior. For instance, effective waste sorting on campus requires educational courses (curriculum design), a supportive reward mechanism (incentive system), and a participatory campus culture (cultural atmosphere) to foster optimal outcomes. Thus, when innovating management models, a holistic approach must be adopted, avoiding isolated reforms.

The principle of scientific validity is equally crucial, necessitating that innovative management models be grounded in scientific theories and empirical research. The Theory of Planned Behavior, Social Learning Theory, and Institutional Economics provide robust theoretical frameworks for cultivating green behavior. For instance, the Theory of Planned Behavior helps analyze students' attitudes, subjective norms, and perceived behavioral control related to green actions, allowing for targeted strategies to enhance their intentions. Social Learning Theory encourages the establishment of role models and a positive campus culture, facilitating observational learning. Institutional Economics can guide the design of incentive and constraint mechanisms to modify the cost-benefit expectations of student behaviors. Empirical research methods, such as large-scale surveys and observational studies, can accurately assess the current state of students' green behaviors and the effectiveness of existing management models, providing a scientific basis for innovative practices.

The principle of incentivization is key to motivating student participation in green initiatives. As the primary agents of behavior cultivation, students' active engagement directly impacts outcomes. Innovative management models must incorporate a diversified, multi-tiered incentive system. This includes material incentives like scholarships and rewards for outstanding contributions to green practices, such as supporting energy-saving projects. Additionally, non-material incentives, like honor certificates and awards for exemplary green behavior, can enhance students' sense of achievement. Linking green behavior performance to overall evaluations and awards can further encourage students to engage in sustainable practices.

5.2 Innovative Approaches

From the perspective of conceptual innovation, universities should adopt a comprehensive green education philosophy. Traditional educational focus on knowledge transfer often neglects the cultivation of students' green literacy. In the context of carbon neutrality goals, it is essential to integrate the concept of sustainable development into the entire educational process. This involves increasing the proportion of environmental science and sustainable development courses while reforming non-environmental curricula to include relevant topics such as energy-saving technologies and green manufacturing processes, subtly embedding green concepts into students' learning experiences. In campus management, green principles should permeate planning, construction, and operational phases, with infrastructure such as solar lights and rainwater collection systems to immerse students in a green environment, facilitating a holistic educational transformation from knowledge transmission to value shaping and behavior cultivation.

In terms of management mechanism innovation, a collaborative framework should be established. Internal departments, including student affairs, logistics, academic units, and research institutions, must break down barriers and unite efforts. The student affairs department can organize various green-themed campus activities to stimulate student participation. The logistics department can enhance hardware support through effective campus resource management practices. Academic units should integrate green education into the curriculum, elevating students' awareness of sustainability. Research institutions can leverage their expertise to promote green technology development and environmental behavior research. Collaborations with external entities, such as environmental organizations, can enhance practical opportunities for students and broaden platforms for green behavior engagement.

Data-driven decision-making represents another significant innovative approach. With the rapid advancement of information technology, big data is increasingly utilized in educational management. Universities can harness big data to collect comprehensive information on students' green behaviors, including energy consumption, waste sorting accuracy, and low-carbon travel frequency. Analyzing these data will reveal behavioral patterns and differences across disciplines, grades, and demographics, allowing for the creation of personalized and precise management strategies. For example, targeted educational activities can be implemented for disciplines or grades with lower engagement in green behaviors, transitioning management from experience-driven to data-driven, ultimately enhancing efficiency.

6. PATHWAYS FOR INNOVATIVE MANAGEMENT MODEL DEVELOPMENT UNDER THE CARBON NEUTRALITY GOAL

6.1 Conceptual Innovation and Cultural Development

Conceptual innovation serves as the foundational ideology for promoting green behavior among university students. Institutions should incorporate carbon neutrality objectives into strategic planning, recognizing the significance of fostering such behavior in enhancing both sustainability and institutional reputation. Clear targets for improving students' green literacy should be established alongside corresponding educational reforms and environmental standards. For instance, future plans may include mandating environmental education courses for all students, with quantifiable targets for energy consumption and waste reduction.

In integrating green concepts into the curriculum, a comprehensive green curriculum structure should be developed. Besides specialized environmental science courses, green principles should be embedded in other disciplines. For example, economics courses can discuss green and circular economies, examining the interplay between economic growth and environmental protection. Incorporating interdisciplinary perspectives enhances students' understanding of sustainable development and broadens their environmental knowledge. Blended teaching approaches can enrich the curriculum, utilizing online platforms for self-directed learning alongside interactive classroom activities.

Fostering a green campus culture is essential for creating an environment conducive to green behavior. Diverse green-themed activities, such as competitions and photography contests focused on sustainability, can engage students across disciplines. Implementing eco-friendly landscaping, like rain gardens, not only beautifies the campus but also serves as a practical educational resource, showcasing ecological principles and technologies. This immersive experience can deepen students' appreciation for sustainability.

6.2 Institutional Optimization and Mechanism Enhancement

Optimizing institutional structures is critical for effective management of green behavior cultivation. Establishing a robust incentive system with diverse reward programs is vital. Initiatives such as "Green Behavior Scholarships" for students consistently excelling in resource conservation and waste management can sustain engagement. Monthly recognition programs can also enhance student morale by providing

acknowledgments and rewards.

Additionally, an effective constraint system must be implemented to mitigate negative behaviors like resource wastage. Violations such as improper use of high-power appliances can be addressed through appropriate disciplinary measures linked to overall evaluations.

Enhancing management mechanisms requires establishing a collaborative governance structure involving various stakeholders, including student services, logistics, academic departments, and student organizations. Regular joint meetings can facilitate communication and coordination, fostering a collaborative environment.

Incorporating third-party evaluation mechanisms can further enhance the scientific rigor of management models. Engaging specialized education or environmental assessment agencies to evaluate students' green behavior outcomes can provide objective insights. By employing comprehensive assessment metrics across various dimensions, universities can adjust management strategies based on evaluation feedback, continuously improving green behavior cultivation efforts.

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How Music Education Enhances Social Skills Development in Children with Autism

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Abstract: This study investigates effective pathways for music education to promote social skills development in children with autism. Through a literature review, we synthesized relevant theoretical findings from both domestic and international sources. Combining experimental research, we selected children diagnosed with autism according to established criteria and designed a systematic music education intervention program, including rhythm training, choir practice, and instrumental ensemble. During the intervention, we utilized specialized tools such as the Social Responsiveness Scale (SRS) and the Communication and Symbolic Behavior Scales (CSBS) to quantitatively assess dimensions such as social interaction, communication willingness, and emotional expression before and after the intervention. Qualitative analysis was also employed to explore the underlying mechanisms through which music education affects social skills development. Results indicate that music education significantly enhances social participation, nonverbal communication abilities, and peer cooperation awareness in children with autism, providing a unique platform for social interaction due to its multisensory stimulation and emotional resonance. Structured rhythmic and melodic elements help children establish stable social expectations, thus promoting their social skills development.

Keywords: Music education; autism; social skills; intervention research; special education.

1. INTRODUCTION

1.1 Background and Significance

With the deepening study of children's developmental disorders, the prevalence of Autism Spectrum Disorder (ASD) has been steadily rising, with approximately 1-2 cases diagnosed per 100 children globally. Core characteristics of this group include social interaction difficulties, repetitive behaviors, and restricted interests, with social skill deficits severely impacting their integration into society, interpersonal relationships, and academic development. Traditional interventions, such as Applied Behavior Analysis (ABA) and speech therapy, have shown effectiveness in improving cognitive functions, yet their ability to foster social-emotional connections is limited. Music education, as a vital medium for nonverbal communication, leverages its unique rhythms, melodies, and harmonies to open new avenues for social skills development in children with autism. Musical stimuli can activate brain reward systems, limbic systems, and mirror neuron networks, promoting dopamine secretion and emotional resonance, providing a scientific basis for music interventions. From a practical perspective, music activities inherently possess group and interactive characteristics, allowing collective singing and instrumental ensemble formats to guide children with autism in social interactions within a safe environment, thereby reducing social anxiety. Investigating the role of music education in enhancing social skills not only contributes to refining the theoretical framework of special education interventions but also offers practical guidance for improving the quality of life of children with autism and promoting educational equity.

1.2 Review of Domestic and International Research

Internationally, research on the application of music therapy in autism intervention began early. The American Music Therapy Association (AMTA) has confirmed that rhythmic interventions significantly enhance attention and motor coordination in children with autism. The Nordoff-Robbins music therapy model utilizes improvisational music creation to help children establish nonverbal communication channels, with research

showing that 73% of children exhibit proactive social behaviors after six months of intervention. Japanese scholars have integrated taiko drumming into collective interventions, finding a 42% increase in eye contact duration and a 35% improvement in physical collaboration frequency among participants. In contrast, domestic research, though initiated later, has rapidly developed. Scholars have pointed out that the standardized mean difference (SMD) for music interventions in social skills among children with autism reaches 0.68, significantly higher than conventional intervention groups. Some studies focus on specific musical forms, such as the Orff music teaching method, which promotes body awareness and interaction, resulting in a 51% increase in social initiation behaviors after 12 weeks of intervention. However, existing research has three limitations: first, intervention programs are often based on experience and lack cross-validation with neurobiological mechanisms and behavioral data; second, there is insufficient long-term follow-up research to assess the sustainability of intervention effects; third, there is a weak construction of localized intervention models that do not sufficiently integrate Chinese culture and educational contexts.

1.3 Research Objectives and Content

The core objective of this study is to reveal the underlying mechanisms through which music education promotes social skills development in children with autism by constructing a standardized intervention plan. The specific research contents include: explaining the activation effects of musical stimuli on social-related brain regions based on neuroscience theories; designing a music education intervention program that includes modules like rhythm training, melody imitation, and improvisation; employing multiple methods such as eye-tracking, behavioral observation, and parent questionnaires to quantitatively assess changes in social eye contact, emotional expression, and cooperative behavior before and after the intervention; exploring the synergistic effects of music education with other intervention methods, and proposing localized optimization strategies for music interventions.

2. THEORETICAL BASIS AND CONCEPT DEFINITION

2.1 Theory of Social Skills Development in Children with Autism

The development of social skills in children with autism is constrained by multiple factors. Neurobiological theories suggest that deficits in the mirror neuron system hinder effective imitation of others' behaviors and understanding emotional cues. The lack of Theory of Mind makes it difficult for children with autism to infer others' intentions and mental states, leading to social interaction challenges. Social learning theory posits that environmental stimuli and reinforcement mechanisms influence the acquisition of social behavior. As children with autism lack effective social learning templates, they struggle to develop social skills through observation and imitation. These theories provide a basis for understanding the roots of social difficulties in children with autism and form a foundation for selecting intervention targets in music education.

2.2 Theoretical Basis for Music Education Interventions

The effectiveness of music education interventions is supported by interdisciplinary theories. Embodied cognition theory emphasizes that the interaction between the body and the environment shapes cognition; thus, embodied experiences within music activities—such as physical movements and instrument manipulation—can enhance children's perception and understanding of social contexts. Neuroplasticity theory indicates that musical stimuli can reshape brain neural networks, enhancing connectivity in social-related brain regions such as the temporal and frontal lobes. Emotional contagion theory posits that musical rhythms and melodies can evoke group emotional resonance, allowing children with autism to establish emotional connections unconsciously through synchronized musical activities, thus breaking through social barriers.

2.3 Definition of Core Concepts

Autism Spectrum Disorder refers to a group of neurodevelopmental disorders characterized by social communication deficits, repetitive behaviors, and restricted interests, encompassing subtypes such as autism and

Asperger syndrome. Social skills refer to an individual's ability to engage in information exchange, emotional interaction, and cooperative coordination in social interactions. This study focuses on observable behavioral indicators in children with autism, including frequency of eye contact, instances of social initiation, and intensity of emotional responses. Music education interventions involve systematically designed music activities (singing, instrument playing, music games) combined with principles of behavioral intervention to promote social skills development in children with autism.

3. RESEARCH METHODS

3.1 Literature Review Method

We systematically searched databases such as CNKI, Wanfang, PubMed, and Web of Science using keywords like “Autism,” “Music Therapy,” “Social Skills,” and to select core journal articles, theses, and authoritative reports from the past decade. CiteSpace software was utilized for co-citation analysis, creating knowledge maps to identify research hotspots and trends. Quality evaluation of included literature was performed using the JBI critical appraisal checklist, resulting in 47 studies with high evidence levels, providing a basis for theoretical construction and program design.

3.2 Experimental Research Method

A randomized controlled experimental design was employed, selecting 80 children aged 6-12 diagnosed according to DSM-5 criteria, randomly divided into an experimental group and a control group of 40 each. The experimental group received music education intervention three times per week for 45 minutes each session over 16 weeks, while the control group received conventional interventions (e.g., ABA, speech therapy). Pre-, mid-, and post-intervention phases involved recording children's gaze duration and focus area distribution during social interactions using eye-tracking technology, documenting social behavior frequency with a Behavioral Observation Scale (BOS-ASD), and conducting parent questionnaires (SRS-2) to assess changes in family social functioning.

3.3 Assessment Tools and Data Processing

Standardized assessment tools were selected to ensure data validity and reliability. The second edition of the Social Responsiveness Scale (SRS-2) includes five subscales, with a Cronbach's α coefficient of 0.89; the Children’s Social Behavior Observation Scale (BOS-ASD) underwent cross-cultural adaptation, achieving inter-rater reliability of 0.91. Eye-tracking data were analyzed using Tobii Pro Lab software, while behavioral data were processed using SPSS 26.0 with repeated measures ANOVA, establishing a significance level of $p<0.05$. Structural equation modeling (SEM) was employed to explore direct and indirect pathways of music intervention's effects on social skills, supplemented by qualitative interviews to enrich quantitative analyses.

4. DESIGN OF THE MUSIC EDUCATION INTERVENTION PROGRAM

4.1 Principles of Intervention Program Design

The intervention program follows four key design principles: the principle of neuroplasticity, which designs low-frequency repetitive, multisensory music activities based on the developmental characteristics of children's brains to promote synaptic growth; the individualization principle, which categorizes children’s ability levels through baseline assessments and sets incremental intervention goals; the contextualization principle, which embeds music activities into daily social scenarios (e.g., meals, games) to enhance skill generalization; and the collaboration principle, which involves music therapists, special education teachers, and parents in a cooperative intervention community to ensure consistency and sustainability.

4.2 Intervention Content and Implementation Process

The intervention content is divided into three modules: the foundational perception module, including rhythm imitation (clapping, stomping) and pitch discrimination (tapping sound blocks) to strengthen auditory-motor integration; the interactive expression module, which trains alternate communication skills through call-and-response singing and instrumental ensemble, designed to guide children in responding to musical cues; and the creative expansion module, focusing on improvisational music creation using

electronic synthesizers and percussion instruments to stimulate children's willingness to express themselves. The implementation process consists of an assessment phase (weeks 1-2), an intervention phase (weeks 3-14), and a consolidation phase (weeks 15-16), with clear behavioral goals and evaluation points established for each phase.

4.3 Features of the Intervention Program

Innovation in the program is reflected in three aspects: first, it integrates brain-behavioral coordinated interventions, synchronously monitoring EEG signals and behavioral performance during music activities to adjust intervention intensity in real-time; second, it develops localized music materials by selecting ethnic music such as "Jasmine Flower" and "Chasing Clouds," combined with dialect nursery rhymes to enhance cultural adaptability; third, it constructs a family extension model by compiling a "Family Music Intervention Guide" and designing parent-child music games, extending the intervention setting from institutions to families to create a 24-hour intervention ecology.

5. EXPERIMENTAL PROCEDURE AND DATA COLLECTION

5.1 Selection and Grouping of Subjects

To ensure the reliability and validity of the experimental results, the study rigorously selected subjects. The research team collaborated with various specialized autism rehabilitation institutions and special education schools to recruit eligible autistic children. Comprehensive assessments were conducted based on the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), including clinical interviews, behavioral observations, and standardized psychological testing tools. A total of 80 autistic children, aged 6 to 12 years—characterized by high brain plasticity and urgent social skill development needs—were selected, showing a relatively positive response to intervention measures.

Using a random number table, the 80 children were randomly assigned to an experimental group and a control group, each consisting of 40 participants. Factors such as age, gender, severity of autism, and baseline social skills were considered in a stratified randomization strategy to ensure no significant differences ($p>0.05$) between the groups in key variables, thereby minimizing confounding influences on the experimental results. This scientifically rigorous group assignment laid a solid foundation for accurately assessing the effects of music education interventions.

5.2 Implementation of Intervention

Children in the experimental group underwent a meticulously designed music education intervention, occurring three times weekly for 45 minutes each session over a 16-week period. The intervention strictly adhered to a predetermined plan executed by professional music therapists and special education teachers.

In the foundational perception module, therapists guided children through diverse rhythmic imitation activities, such as clapping and stomping, to enhance their auditory-motor integration skills. For instance, using the simple children's song "Two Tigers," therapists first played the audio for children to experience its lively rhythm, then encouraged children to hum along while clapping in time with the song's rhythm, gradually increasing their sensitivity and responsiveness to rhythm. Height discrimination activities involved therapists randomly striking blocks of different pitches, prompting children to mimic the same pitches, establishing pitch concepts through repeated practice.

In the interactive expression module, call and response, along with instrumental ensemble activities, became central. During the call and response segment, therapists selected simple melodies like "Twinkle, Twinkle, Little Star," dividing children into two groups to alternate singing sections of the song, thus training their turn-taking communication skills. In the ensemble activities, children were provided with simple instruments like woodblocks and maracas, and assigned parts based on the acoustic characteristics of the instruments, collectively performing classic pieces like "Radetzky March." This ensured children focused on others' rhythms and melodies, adjusting their performance for overall harmony, effectively promoting teamwork and interaction. Additionally, a "musical dialogue" game was included, where therapists issued specific musical signals, encouraging children to respond in a similar musical form,

enhancing their willingness to engage socially. The creative expansion module involved improvisational music creation activities that sparked children's creativity and willingness to express themselves. Therapists provided a variety of instruments, encouraging children to explore sounds and performance styles freely, creating music segments based on their emotions and imaginations. For example, some children used rapid beats on a snare drum to express excitement, while others played soothing melodies on synthesizers to convey calmness. During this creative process, children listened to and shared ideas with each other, further enhancing the depth and breadth of social interaction.

Children in the control group received conventional interventions, primarily consisting of Applied Behavior Analysis (ABA) and speech therapy. ABA interventions, based on behavioral principles, utilized techniques such as positive reinforcement and extinction to shape and correct target behaviors. For instance, children were rewarded (e.g., with candy or stickers) for correctly following instructions, while undesirable behaviors (e.g., self-harm) were addressed through extinction by withholding attention, gradually reducing such behaviors. Speech therapy focused on developing children's language skills, including pronunciation, vocabulary comprehension and expression, and fluency training, with personalized training plans based on individual language levels.

5.3 Data Collection Methods and Timeline

This study employed a multi-method, multi-phase data collection strategy to comprehensively and accurately assess the effects of the music education intervention.

Data collection occurred at three critical time points: pre-intervention, during the 8th week of intervention, and post-intervention (16th week), using eye-tracking technology to record children's gaze behaviors during social interactions. The experimental setting involved children watching a video containing various social scenarios (e.g., interactive games, greetings, sharing toys). Eye-trackers accurately recorded the duration of children's gaze on different regions of the video, including faces, body movements, and objects, analyzing these data to understand shifts in attention allocation and response to social cues.

The Behavioral Observation Scale for Autism Spectrum Disorder (BOS-ASD) was utilized throughout the intervention period. Professionally trained observers systematically recorded children's social behaviors in natural settings (e.g., intervention classes, breaks) and structured contexts (e.g., specific social interaction tasks). Observational metrics included frequency of social eye contact, number of social initiations (e.g., greeting others, inviting participation in games), emotional expressiveness (facial expressions and body language), and cooperation in group activities. Observers quantitatively scored behaviors based on the scale's criteria to ensure objective and accurate data collection.

Parents completed the Social Responsiveness Scale (SRS-2) before the intervention and after its completion. The questionnaire included five subscales assessing social perception, cognition, communication, motivation, and autism characteristics, providing a comprehensive evaluation of children's social functioning changes in the home environment. Parents provided valuable data based on their children's everyday behavior at home. Additionally, the research team conducted regular interviews with parents during the intervention, gathering qualitative data on children's behavioral changes, parents' experiences, and feedback, enriching the exploration of the intervention's practical impacts.

6. RESULTS AND ANALYSIS

6.1 Quantitative Data Analysis

In-depth analysis of the collected eye-tracking data revealed that children in the experimental group exhibited a significant increase in gaze duration on faces during social scene videos post-intervention ($p<0.05$). Pre-intervention, the average gaze duration on faces was (3.2±1.1) seconds, increasing to (5.8±1.5) seconds post-intervention, representing an 81.25% increase. The distribution of gaze hotspots also shifted significantly, now more focused on critical social cue areas such as eyes and mouths, indicating that the music education intervention effectively enhanced autistic children's attention and recognition of

social cues.

Behavioral Observation Scale (BOS-ASD) data showed significant improvements in social eye contact frequency, number of social initiations, emotional expressiveness, and cooperation among children in the experimental group ($p<0.05$). Social eye contact frequency increased from an average of (2.1±0.8) instances per minute pre-intervention to (4.5±1.2) instances post-intervention, marking a 114.29% increase. Social initiation frequency rose from an average of (3.5±1.3) times weekly to (7.8±2.1) times, a 122.86% increase. Emotional expressiveness scores improved from (10.2±2.5) to (15.6±3.1) points, a 52.94% increase; cooperation scores rose from (8.6±2.2) to (13.5±3.0) points, increasing by 56.98%. In contrast, the control group exhibited minor changes in the same period, with many metrics not reaching statistical significance ($p>0.05$).

The results from the parent questionnaire (SRS-2) also supported the effectiveness of the music education intervention. Scores on subscales for social perception, cognition, communication, and motivation significantly increased in the experimental group ($p<0.05$). For example, the average score for the social communication subscale increased from (35.2±5.6) pre-intervention to (43.8±6.2) post-intervention, a 24.43% improvement, indicating marked enhancement in children's social functioning within the home environment. Repeated measures ANOVA further validated that the music education intervention had a significant main effect on improving social skills in autistic children, with the intervention effect showing a sustained positive trend over time.

6.2 Qualitative Analysis Results

Qualitative interview results provided rich context and interpretation for the quantitative data. Parents widely reported that their children's social initiative at home had notably increased following participation in the music education intervention. For example, one parent remarked, "Previously, my child always played alone and rarely communicated with us. Now, he often brings over the musical instruments he made during music activities to play together and eagerly shares fun experiences from music class." Some parents also observed progress in their children's emotional regulation; music activities became an effective means for children to manage their emotions, quickly calming down when feeling anxious or upset.

Teachers noted positive changes in children's behavior during music classes. Children gradually learned to listen to others' opinions, enhancing their team collaboration awareness. For instance, during ensemble activities, children actively adjusted their playing rhythms to align with the group's overall performance. Some originally introverted children began to interact with peers and engage in collective music games, exhibiting unprecedented enthusiasm and positivity. These qualitative descriptions vividly illustrated the music education intervention's practical effects on improving autistic children's social-emotional experiences and promoting social behaviors, corroborating the quantitative analysis findings and collectively highlighting the positive impact of music education on developing social skills in autistic children.

6.3 Mechanism of Music Education in Promoting Social Skill Development

Integrating quantitative and qualitative research findings, we explored the underlying mechanisms through which music education fosters social skill development in autistic children. From a neurophysiological perspective, musical stimuli activate several critical brain areas, including the reward system, limbic system, and mirror neuron networks. The rhythm, melody, and harmonic information of music are processed through auditory pathways, triggering the brain's reward system to release dopamine, enhancing children's motivation to engage in music activities through pleasurable experiences. Simultaneously, the limbic system activation promotes emotional resonance, aiding children in understanding and feeling others' emotions. The involvement of mirror neuron networks facilitates children's imitation of musical behaviors, which can be transferred to social contexts, improving their understanding and response to behavioral and emotional cues from others.

From a behavioral theory perspective, music education interventions designed a series of music activities with clear objectives and

reinforcement mechanisms, providing ample opportunities for social learning for autistic children. In the foundational perception module, rhythm imitation and pitch discrimination activities strengthened children's sensory integration capabilities, laying the physiological groundwork for subsequent social interactions. The interactive expression module's call and response, ensemble, and "musical dialogue" games utilized behavioral shaping principles to provide timely reinforcement for children's appropriate social responses, gradually cultivating turn-taking communication and teamwork skills. The improvisational creative activities in the creative expansion module encouraged active expression, further solidifying and expanding social skills through shared creative experiences, creating a positive behavioral development cycle.

Cultural and social theory emphasizes the critical role of the environment in individual development. Music education fostered a positive, inclusive social environment where shared goals in group music activities (e.g., completing an ensemble performance) motivated children to collaborate and communicate. Through this social interaction process, children continually learn and internalize social rules and interpersonal communication skills, gradually developing socially expected behavioral patterns. The use of localized musical materials, such as folk music and dialect nursery rhymes, enhanced children's sense of cultural identity and belonging, further promoting emotional connections and comprehensively advancing social skills in autistic children.

7. CONCLUSION

This study systematically explored the role of music education in promoting social skill development among autistic children through comprehensive experimental design and multi-method data analysis. Results indicated that after 16 weeks of music education intervention, children in the experimental group made significant progress across various dimensions of social skills, such as eye contact, social initiation, emotional expressiveness, and cooperation, with noticeable improvements in their social functioning within the home environment—evident in both quantitative data and qualitative descriptions.

The effectiveness of the music education intervention can be attributed to its unique neurophysiological activation mechanisms, scientifically grounded behavioral intervention design, and the creation of a positive socio-cultural environment. This research provides robust empirical evidence for the application of music education in the field of autism intervention, enriching the theoretical framework of special education interventions. Furthermore, the localized music education intervention scheme developed during the study, integrating innovative elements such as brain-behavior coordinated intervention and family extension models, holds significant practical dissemination value, potentially bringing greater benefits to many autistic children and their families.

However, the study has limitations. The sample comprised only autistic children aged 6 to 12, warranting further exploration of intervention effects in other age groups. Additionally, the intervention period was relatively short, and the long-term sustainability of the effects requires further longitudinal research. Future studies could expand the sample range and duration of interventions, exploring optimal collaborative models of music education with other intervention methods to provide more precise and effective support for the social skill development of autistic children.

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Innovation in the Discourse System of Online Ideological and Political Education Management for University Students

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Abstract: This study aims to explore effective pathways for innovating the discourse system of online ideological and political education management for university students to meet the developmental needs of ideological education in the digital era. Utilizing literature review methods, the research organizes domestic and international theories and findings related to online ideological education discourse systems. Through comparative analysis, it examines the characteristics of discourse systems across different cultural contexts and educational models. Theoretical analysis reveals issues within the current discourse system, including unidirectional expression, delayed content, and singular dissemination channels, which fail to address the diverse ideological needs of students. As a solution, this study proposes innovating the discourse system across four dimensions: subject, content, dissemination, and evaluation. A new discourse system characterized by subject collaboration, vibrant content, diverse dissemination, and scientific evaluation is suggested to enhance the effectiveness and resonance of online ideological education management, providing theoretical support and practical guidance for improving the quality of online ideological education in universities.

Keywords: University students; Online ideological education; Discourse system; Innovation research; Educational management

1. INTRODUCTION

1.1 Research Background and Significance

The evolution of internet technology reshapes social interaction and information dissemination, profoundly transforming the field of ideological and political education in universities. According to the 53rd Statistical Report on Internet Development in China, students comprise 29.4% of internet users, with university students averaging over 6 hours of daily internet use and high penetration rates of social media (98.7%) and short video platforms (92.3%). the online space has become a critical arena for shaping students' values and expressing their thoughts. Traditional educational discourse is weakened by fragmented information. Data from the Ministry of Education indicates that only 34.6% of university students find current online ideological education discourse effective in addressing their real-life dilemmas, highlighting the mismatch between the discourse system and online communication norms.

Innovating the discourse system of online ideological education management for university students is essential to navigate the complex ideological struggles. Algorithmic recommendation mechanisms create information cocoons, and Western values infiltrate subtly through media and online communities. As digital natives, students are easily influenced by diverse values. Constructing a discourse system that aligns with online communication characteristics can enhance the guiding power of mainstream ideological discourse in virtual spaces and safeguard national ideological security. From an educational practice perspective, discourse innovation can transcend the limitations of traditional one-way ideological instruction, achieving effective dialogue with students through content reconstruction and innovative dissemination methods, thereby improving the approachability and effectiveness of ideological education.

1.2 Literature Review

International scholars focus on the impact of online communication on ideology and

discourse construction strategies. Hall's encoding-decoding theory reveals the audience's active role in the information transmission process, while Castells emphasizes the challenges posed by the time-space compression of the network society on ideological dissemination. However, Western research tends to be framed within a capitalist ideology, lacking targeted guidance for socialist ideological discourse. Domestic research mainly examines the construction of theoretical frameworks for online ideological education, discourse dilemmas, and innovation pathways. Scholars identify issues such as significant tendencies towards discourse hegemony, insufficient media integration, and a lack of emotional resonance, proposing innovative strategies like subject collaboration and audience-targeted expression. Existing studies provide theoretical support for discourse system innovation but still lack exploration of the interaction between discourse dissemination mechanisms and online subcultures, as well as the construction of quantitative evaluation indicators.

1.3 Research Objectives and Methods

This study aims to construct a discourse system for ideological education management that fits the characteristics of online communication and aligns with university students' cognitive patterns. By deconstructing the elements of the existing discourse system and analyzing its compatibility with online communication ecology, it proposes a systematic innovation pathway incorporating subject, content, dissemination, and evaluation. the study employs bibliometric and content analysis methods to analyze 1, 267 relevant articles from core CNKI journals over the past decade, mapping research hotspots and evolution; it also uses surveys of 5, 682 students from 32 universities to gather data on the acceptance of online ideological discourse; and case studies of successful discourse practices, such as the "Xuexi Qiangguo" platform and the Bilibili video series "Hello, I Am He Tongxue. "

2. OVERVIEW OF THEORETICAL CONCEPTS RELATED TO THE DISCOURSE SYSTEM OF ONLINE IDEOLOGICAL EDUCATION MANAGEMENT FOR UNIVERSITY STUDENTS

2.1 Core Concept Definition

The discourse system of online ideological education management for university students refers to an organic system formed in the online space, focusing on ideological education goals among educators, learners, and communication media, transmitting mainstream ideology and values through discourse symbols. This system includes a discourse subject system (comprising ideological educators, counselors, and online opinion leaders), a discourse content system (encompassing core topics such as Marxism and socialist core values), a dissemination system (utilizing short videos, social media, and learning platforms), and an evaluation system (measuring discourse effectiveness through indicators such as dissemination effects and student acceptance).

2.2 Theoretical Foundations

Habermas's theory of communicative action supports the discourse system construction, emphasizing consensus through equal dialogue and rational communication, aligning with the decentralized dissemination needs of ideological education in the internet age. Agenda-setting theory reveals media's role in guiding public attention, highlighting the need for online ideological discourse to focus on issue planning and hot topic guidance. Meme theory explains the replication and dissemination of cultural information in online spaces, providing insights for the symbolic and engaging innovation of ideological discourse. Additionally, Marxist ideology theory establishes the value foundation of the discourse system, underscoring the leading role of mainstream ideology in online spaces.

3. CURRENT STATUS ANALYSIS OF THE DISCOURSE SYSTEM OF ONLINE IDEOLOGICAL EDUCATION MANAGEMENT FOR UNIVERSITY STUDENTS

3.1 Components of the Discourse System

The discourse subjects exhibit hierarchical characteristics, with professional ideological educators dominating theoretical interpretation, counselors undertaking daily ideological guidance, and student media creators leveraging peer communication

advantages. the discourse content features a coexistence of theoretical, policy, and everyday language, with theoretical discourse focusing on ideological interpretation, policy discourse on policy analysis, and everyday discourse on students' real concerns. the dissemination medium is primarily a matrix layout centered on "WeChat, Weibo, Douyin, " with WeChat used for in-depth content delivery, short video platforms for fragmentary dissemination, and live interactions enhancing discourse impact. the evaluation system combines quantitative and qualitative approaches, with quantitative indicators covering click rates and shares, and qualitative analysis focusing on student feedback and changes in thoughts and behaviors.

3.2 Current Issues in the Discourse System

The lack of collaborative mechanisms among discourse subjects leads to cognitive gaps between professional educators' theoretical discourse and students' everyday discourse, resulting in transmission blockages in educational information. Discourse content exhibits delayed responsiveness to online hot events, averaging a lag of 3.2 days, failing to meet students' immediate information needs; some theoretical expressions are abstract, with 67.8% of students reporting difficulty in understanding professional jargon. Dissemination channels face integration barriers, with severe content homogenization across different media platforms and a cross-platform conversion rate below 15%. the evaluation system overly emphasizes dissemination data statistics, lacking scientific tools to measure the internalization of students' values; only 12.3% of universities have established tracking and assessment mechanisms for thoughts and behaviors.

4. NECESSITY OF INNOVATING THE DISCOURSE SYSTEM OF ONLINE IDEOLOGICAL EDUCATION MANAGEMENT FOR UNIVERSITY STUDENTS

4.1 Inevitability of Development in the Network Era

Emerging technologies such as the metaverse and AIGC are reshaping online communication ecology, giving rise to new forms of discourse expression through virtual digital humans and immersive scenes. Algorithmic recommendations create "filter bubble" effects, and if university ideological discourse does not proactively adapt to technological changes, it risks becoming ineffective. the accelerated legalization of online space governance and policies like the "Regulations on the Ecological Governance of Online Information Content" necessitate innovative ideological discourse to enhance the dissemination of mainstream values and constrain harmful information.

4.2 Real Needs for Addressing Students' Ideological Demands

Generation Z students exhibit diverse value orientations, fragmented information acquisition, and personalized expression demands. Surveys indicate that 76.4% of students prefer gaining ideological inspiration through online social interactions, while only 23.1% are receptive to didactic discourse. the flourishing of online subcultures, including fan culture and ACG (Anime, Comic, Game) culture, poses potential challenges to mainstream values, necessitating innovative expression methods in ideological discourse to facilitate cultural dialogue and value guidance. Students' real-life dilemmas are increasingly complex, with issues such as employment pressure, emotional challenges, and psychological anxieties requiring ideological discourse to provide professional guidance and humanistic care.

5. INNOVATION PATHS FOR THE DISCOURSE SYSTEM OF IDEOLOGICAL AND POLITICAL EDUCATION MANAGEMENT FOR UNIVERSITY STUDENTS ONLINE

5.1 Collaborative Innovation of Discourse Subjects

Break down hierarchical barriers among traditional discourse subjects to establish a collaborative discourse framework involving diverse stakeholders. Universities should create a collaborative education platform comprising "ideological and political educators, counselors, student opinion leaders, and online platform operators. " Regular online and offline discussions should be held to facilitate knowledge sharing and experience integration among different stakeholders. Ideological educators, with their strong

theoretical foundation, provide academic support for online discourse; counselors accurately gauge student sentiment based on daily observations and feedback on discourse needs; student opinion leaders translate mainstream values into relatable online language from a peer perspective, enhancing discourse affinity; online platform operators leverage technological advantages to optimize discourse dissemination strategies. For instance, establishing "Online Ideological and Political Workshops" could involve multiple parties in planning discussions around trending topics, generating targeted and engaging discourse content, thereby transforming from a singularly led to a collaboratively governed paradigm, enhancing the reach and guidance of online ideological discourse.

5.2 Content Optimization and Innovation

Reconstruct the content system of online ideological discourse based on the characteristics of online communication and student cognitive needs. This includes promoting the segmentation and precision of discourse content, using big data analytics to tailor personalized content according to various student demographics, such as majors, year levels, and interests. For example, for science and engineering students, linking cutting-edge technological achievements to the principles of Marxist dialectical materialism might be effective, while cultural analyses of socialist core values could be directed at humanities students. Furthermore, ensuring the timeliness and relevance of discourse content by closely monitoring online hot topics and responding within 24 hours can enhance its appeal and effectiveness. Additionally, extracting educational elements from excellent traditional Chinese culture, revolutionary culture, and advanced socialist culture, and presenting them in storytelling and visual formats—such as "red story micro-animations" or "cultural celebrity short videos"—can convert abstract theories into vivid cultural symbols, strengthening students' identification and sense of belonging with mainstream values.

5.3 Expansion and Innovation of Dissemination Channels

Construct a multimedia integrated communication matrix to transcend the limitations of traditional media platforms. Integrate resources from social media platforms like "WeChat, Weibo, and Douyin, " online learning platforms, and campus broadcasting stations to achieve a unified operation of content production, distribution, and interactive feedback. Each platform should leverage its strengths; for example, WeChat can deliver in-depth content in visually rich formats, while Weibo can harness trending discussions to stimulate student engagement and broaden discourse influence. Short video platforms can utilize creative video production for engaging, fragmented content, capturing student attention, while online learning platforms should provide systematic course resources to meet students' deeper learning needs. Moreover, exploring emerging technologies, such as the metaverse for immersive ideological education scenarios, allows students to experience the allure of red culture in virtual environments. Utilizing AIGC technologies to generate personalized learning resources can achieve precise dissemination and enhance communication effectiveness.

5.4 Improvement and Innovation of Evaluation Systems

Establish a diverse evaluation system centered on the internalization of student values and behavioral changes. In terms of quantitative indicators, besides click rates and shares, metrics like learning duration, interaction frequency, and knowledge retention should be included to comprehensively assess student engagement and learning outcomes. For instance, tracking the time students spend watching ideological course videos and their assignment completion can measure their investment in learning, while monitoring participation frequency and quality of discussion on social media can evaluate interaction depth. Qualitative analysis methods, such as in-depth interviews and focus group discussions, can be employed to gather students' subjective experiences and feedback on online ideological discourse, shedding light on their value transformation processes. Additionally, sentiment analysis techniques can be applied to evaluate students' emotional inclinations toward mainstream values based on comments made on online platforms. A long-term tracking mechanism

should also be established to assess students' ideological and behavioral outcomes post-graduation, providing a scientific basis for the continuous optimization of the discourse system.

6. CONCLUSION

This study systematically analyzes the discourse system of ideological and political education management for university students online, revealing existing issues and proposing innovative paths from four dimensions: subjects, content, dissemination, and evaluation. the research indicates that innovating the discourse system in the context of online ideological and political education is a complex systemic project that requires collaborative participation from diverse stakeholders, deep integration of content and forms, innovative dissemination channels, and scientifically sound evaluation systems. Future research may further focus on the application of new technologies and guidance of online subcultures to explore the dynamic evolution of the discourse system in ideological and political education, providing ongoing theoretical support and practical guidance for enhancing the quality of ideological and political education in universities.

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Research on the Reform of Public English Curriculum in Higher Vocational Colleges Based on Outcome-Based Education

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Abstract: In response to the demand for high-quality development in vocational education, this study addresses issues such as vague teaching objectives and disconnection between course content and professional requirements in public English courses in higher vocational colleges. Guided by Outcome-Based Education (OBE) theory, this research explores the reform of these courses. A literature review assesses the current application and theoretical foundation of OBE in language teaching, complemented by surveys and interviews with students and teachers from multiple colleges to analyze existing pain points in teaching. Based on the findings, the study proposes reforms focusing on defining teaching objectives centered on vocational competencies, restructuring teaching content aligned with professional scenarios, and innovating diverse evaluation systems. The results indicate that the OBE-based reforms can effectively enhance students' English proficiency and professional qualities, improve the alignment between courses and job roles, and promote innovation in teaching philosophies and methods. Furthermore, a practical OBE model for public English curriculum reform is established, providing theoretical references and practical insights for similar institutions.

Keywords: Outcome-Based Education; Public English in Higher Vocational Colleges; Curriculum Reform; Vocational Competencies; Teaching Model

1. INTRODUCTION

1.1 Background and Significance

As globalization accelerates and cross-border business activities increase, the demand for English proficiency in vocational fields is diversifying and professionalizing. The Ministry of Education's "Action Plan for Enhancing Quality in Vocational Education" emphasizes the need for deeper integration of industry and education, strengthening students' practical skills and professional qualities. Public English courses in vocational colleges play a crucial role in cultivating students' workplace English communication skills and supporting regional economic development. However, traditional teaching methods often suffer from unclear course positioning, disconnected content from professional contexts, and a lack of diverse assessments, failing to meet the new demands for talent cultivation.

OBE focuses on the final learning outcomes, emphasizing backward design of teaching processes that align closely with job competency requirements. Introducing OBE into public English curriculum reform can effectively reconstruct course objectives, content, and evaluation systems, facilitating a deeper integration of teaching processes with vocational skill development. This research not only aims to enhance the theoretical framework of English courses in vocational education but also provides practical guidance for improving teaching quality and cultivating well-rounded technical talents, contributing significantly to high-quality vocational education development.

1.2 Review of Current Research

The OBE concept originated in the 1980s, with Spady establishing its theoretical framework that prioritizes student outcomes in teaching design and implementation. Countries like the USA and Canada have integrated OBE into ESL programs, creating competency-based language training systems that significantly enhance students' language application abilities. The UK's BTEC curriculum, focused on outcome-oriented vocational capabilities, utilizes project-based

learning and diverse evaluations as successful models for vocational English teaching reform. In China, research on OBE began in the early 2000s, initially focusing on theoretical introduction and conceptual clarification. Recent years have seen broader applications in vocational college curricula amidst ongoing reforms. Some institutions have attempted to combine OBE with English courses by analyzing job-specific English competencies and restructuring teaching objectives and content. However, existing research often remains anecdotal, lacking systematic evaluations of reform outcomes and theoretical depth. There is still no comprehensive, scientific, and universally applicable OBE teaching model for public English curriculum reform.

1.3 Research Objectives and Content

This study aims to explore the paths for reforming public English courses in higher vocational colleges under the OBE framework, constructing an English teaching model that aligns with vocational education characteristics. Specific research tasks include: analyzing the connotations and core elements of OBE theory and its applicability in public English teaching; conducting surveys and interviews to comprehend the current teaching situation and identify existing issues; proposing reform strategies from four dimensions: restructuring teaching objectives, optimizing content, innovating teaching methods, and reforming evaluation systems; implementing reform practices, evaluating effectiveness, summarizing experiences, and suggesting improvements.

2. OVERVIEW OF OUTCOME-BASED EDUCATION (OBE) THEORY

2.1 Core Elements of OBE Theory

OBE theory starts with desired learning outcomes, emphasizing that educational activities should revolve around these expectations. This entails backward design and forward implementation to ensure consistency among teaching objectives, processes, and evaluation systems. Its core elements include: clearly defining learning outcomes; designing the teaching process backward based on these outcomes; continually improving teaching quality through multidimensional evaluations; and ensuring the success of all students with differentiated support.

In public English teaching, the OBE framework requires translating job-specific English competency demands into concrete learning outcomes, guiding the design of teaching activities to ensure students can adeptly apply English in real work contexts, thus transforming knowledge accumulation into capability enhancement.

2.2 Applicability of OBE Theory in Vocational Education

Vocational education aims to cultivate skilled talents to meet societal needs, emphasizing a close alignment between education and industry. The outcome-oriented and demand-driven characteristics of OBE align well with vocational education principles. Applying OBE in public English teaching allows for precise alignment with job-specific English competency requirements, shifting the traditional focus from mere knowledge transmission to capability development.

Surveys across multiple industries reveal significant demands for English communication skills, business writing abilities, and foreign business handling capacities in fields like international trade, cross-border e-commerce, and hotel management. OBE can guide course objectives and content to meet these specific competency needs, employing project-based learning and situational simulations to enhance students' English application abilities and improve their competitiveness in the job market, thereby ensuring alignment between vocational education talent cultivation and societal demands.

3. CURRENT STATUS AND ISSUES IN PUBLIC ENGLISH TEACHING

3.1 Survey of Course Teaching Status

To comprehensively understand the current status of public English teaching, this study combines surveys and interviews with 1,200 students and 80 English teachers from 20 vocational colleges nationwide. Results show that only 35% of courses clearly articulate objectives related to job competencies, while most remain focused on general English knowledge. Additionally, 70% of teaching materials are disconnected from professional scenarios, lacking practical content like

business English. In terms of teaching methods, 65% of classes rely primarily on teacher lectures, resulting in low student engagement. Furthermore, 80% of courses employ a singular evaluation method of "final exams + daily scores," failing to comprehensively assess students' English application abilities.

Interviews reveal that teachers frequently cite unclear course positioning and insufficient resources, while students express concerns over the practicality of course content in meeting future career needs.

3.2 Analysis of Major Teaching Issues

The primary issues in current public English teaching include: firstly, a lack of job-oriented objectives that fail to consider the specific English competency needs of different professional students, leading to diminished student motivation. Secondly, outdated content that does not align with industry developments fails to meet new employer requirements for English proficiency. For instance, in the cross-border e-commerce sector, emerging practices like live-stream selling and cross-border social media marketing have significantly increased demands for skills such as English communication for live broadcasts and cross-border platform interactions, yet current teaching content is insufficiently addressed.

Moreover, teaching methods are overly simplistic, with traditional lecture formats failing to engage students and provide opportunities for language practice, hindering the development of practical language skills. Lastly, an inadequate evaluation system relies solely on examinations, which do not reflect the comprehensive language application abilities necessary for cultivating students' professional qualities.

4. STRATEGIES FOR REFORMING PUBLIC ENGLISH CURRICULUM BASED ON OBE

4.1 Restructuring Teaching Objectives

Following the OBE philosophy, restructured teaching objectives should be guided by job-specific English competency needs. In-depth industry research will help delineate the necessary English knowledge and skills for various positions, transforming them into specific teaching goals. For instance, for international trade majors, objectives might include "effectively communicating in English during business negotiations" and "accurately writing international trade documents." For hotel management, goals could include "communicating in English for front desk and room service" and "mastering English hosting skills for hotel-related foreign activities."

Additionally, objectives should be categorized into basic, expanded, and developmental goals to cater to varying student levels, ensuring that all students achieve competency enhancements.

4.2 Optimizing Teaching Content

Teaching content optimization must closely align with restructured objectives, integrating general and vocational English to create a modular curriculum. Content modules could include foundational English, industry-specific English, and professional development topics. The foundational module should focus on essential language skills, while the industry module could encompass specifics like international trade English, cross-border e-commerce English, and tourism English. The professional development module can cover intercultural communication and business etiquette.

In selecting and developing teaching materials, priority should be given to resources aligned with industry standards and contemporary developments, encouraging teachers to create institution-specific materials that reflect regional industry needs, such as developing resources related to the local cross-border e-commerce sector.

4.3 Innovating Teaching Methods

To enhance students' English application abilities, innovative and diversified teaching methods should be employed. Project-based learning can introduce real-world tasks into the classroom, such as simulating business negotiations or cross-border e-commerce customer service, allowing students to enhance their comprehensive English skills through practical engagement. Situational teaching can create authentic or virtual contexts like hotel front desk services or international exhibition receptions, enabling immersive learning experiences that boost language proficiency.

Moreover, integrating modern information

technology through blended teaching can provide a wealth of online resources while enhancing in-class interactions. Implementing flipped classroom models allows students to learn independently before class and engage in practical applications and discussions during class, improving learning efficiency and participation.

4.4 Reforming the Evaluation System

A robust OBE-oriented evaluation system should adhere to principles of diversity, process orientation, and developmental focus. Evaluation participants should include teachers, students, and industry professionals, employing self, peer, teacher, and employer assessments. Evaluation criteria should encompass not only knowledge of English but also assess students' abilities in real-world scenarios, teamwork, and problem-solving skills.

The evaluation approach should blend formative assessments, such as classroom participation and project work, with summative assessments, like situational simulations and project presentations, to comprehensively evaluate students' capabilities. A dynamic feedback mechanism should be established to adjust teaching strategies based on evaluation outcomes, fostering ongoing improvements in teaching quality.

5. PRACTICE AND EFFECTIVENESS OF OUTCOME-BASED TEACHING REFORM

5.1 Reform Practice Process

Three representative vocational colleges were selected as reform practice bases, covering diverse professional types and regional characteristics. In the initial phase, a curriculum reform team comprised of English teachers, subject specialists, and industry experts was established to conduct a needs assessment of English proficiency in vocational contexts. Through surveys and in-depth interviews with over 200 companies, a list of English competencies required for ten popular majors—such as International Trade, Tourism Management, and Computer Applications—was compiled, specifying the necessary knowledge, skills, and qualifications for each role.

Based on the findings, the teaching objectives were restructured. For instance, in the Tourism Management program, specific abilities were defined, including the ability to communicate in English for tourist site introductions, itinerary planning, and handling emergencies. The teaching content was optimized to integrate general and vocational English, leading to the development of school-based textbooks that include modules on tourism English listening and speaking, reading and writing, and intercultural communication. Additionally, real-world projects, such as international tour reception and overseas tourism product marketing, were incorporated via an online course platform to enrich teaching resources.

Innovative teaching methods were adopted, combining project-based learning with contextual instruction. In the international tour reception project, authentic scenarios such as airport pickups, hotel check-ins, and guided tours were created, with students assuming different roles and using English to complete various tasks. Through the online learning platform, students engaged in self-directed study before class, followed by practical operations and group discussions, with real-time guidance and feedback from instructors.

The evaluation system was also reformed, establishing a multi-faceted evaluation mechanism involving diverse stakeholders. Self-assessment focused on students' reflection and growth; peer assessment encouraged collaboration; teacher assessments emphasized knowledge acquisition and skill enhancement; and industry expert evaluations assessed practical abilities and professional qualities. The evaluation approach combined formative and summative assessments, with formative evaluations—covering classroom performance, project work, and group participation—accounting for 60% of the total score, while summative assessments, including simulated tests and project presentations, constituted 40%.

5.2 Assessment and Analysis of Reform Effects

After one academic year of reform implementation, various methods were utilized to assess the outcomes. A comparison of students' English proficiency test scores pre- and post-reform revealed significant

improvements in listening comprehension, speaking, and business writing, with average scores increasing by 12 points, particularly notable in speaking, which rose by an average of 15 points. Survey results indicated that 85% of students felt their English application skills had improved, along with a notable increase in learning interest and initiative; 90% of teachers reported enhanced classroom participation and an improved learning attitude among students.

Feedback from participating enterprises showed that 80% believed that the interns' English communication and problem-solving abilities met job requirements, demonstrating considerable progress compared to previous interns. Tracking graduate employment revealed a 15% increase in employment rates for graduates in foreign-related positions, alongside significantly improved job quality.

Further analysis indicated that outcome-based teaching reforms effectively motivated students, enhancing both their English proficiency and professional qualities while aligning the curriculum more closely with job market demands. Additionally, the reform encouraged teachers to update their teaching philosophies and enhance their teaching capabilities, fostering a student-centered educational culture. However, challenges such as insufficient teaching resources and the need for improved interdisciplinary teaching skills were noted, guiding future improvements.

6. CONCLUSION

This study conducted an in-depth exploration of the teaching reform in vocational English courses based on the outcome-based education (OBE) concept. Through theoretical analysis, current status investigation, strategy proposals, and practical validation, it concluded that OBE theory is highly compatible with vocational English teaching, effectively addressing issues such as ambiguous teaching objectives, disconnects between content and job requirements, limited teaching methods, and inadequate evaluation systems.

By restructuring teaching objectives, optimizing content, innovating teaching methods, and reforming evaluation systems, a model of outcome-based vocational English instruction was established. Practical evidence demonstrated that this model significantly enhances students' English application abilities and professional qualities, thereby improving their employability. However, ongoing challenges related to resource availability and interdisciplinary teaching capabilities require continuous refinement. Future efforts should deepen the application of OBE in vocational English education, strengthen inter-institutional collaboration and resource sharing, and promote high-quality development in vocational English education to support the cultivation of versatile technical talents suited to contemporary demands.

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Construction and Implementation of an Evaluation System for University Physical Education Courses

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Abstract: As higher education reforms advance, establishing a comprehensive and scientific evaluation system for university physical education courses becomes essential for enhancing teaching quality and promoting students' physical and mental well-being. This study aims to develop an evaluation system that meets the requirements of the new era and explores effective implementation pathways. By employing literature review and the Delphi method, we engaged experts in physical education for multiple rounds of validation on the evaluation indicators. Utilizing the Analytic Hierarchy Process (AHP), we constructed an evaluation framework consisting of five primary indicators—teaching objectives, content, methods, processes, and outcomes—with 23 secondary indicators. For implementation, we propose strategies including a dynamic evaluation mechanism, enhanced teacher training, and the use of information technology to ensure the effective application of the evaluation system. Our findings indicate that the newly developed evaluation system is scientific, systematic, and actionable, capable of comprehensively and objectively reflecting the quality of university physical education, providing theoretical basis and practical guidance for reforming physical education in higher education, and facilitating high-quality development in university physical education.
Keywords: University physical education; Evaluation system; Indicator construction; Implementation pathways; Teaching quality

1. INTRODUCTION

1.1 Background and Significance

In the context of the "Healthy China 2030" strategy and the deepening of the "Five Educations" approach in higher education, the quality of university physical education courses significantly impacts student development and lifelong fitness habits. The Ministry of Education has called for improvements in physical education evaluation mechanisms, yet current practices often focus on outcomes over processes, have limited evaluators, and utilize outdated indicator systems. Surveys reveal that 62% of evaluations rely predominantly on physical fitness test scores, while only 28% consider learning attitudes and progress, making traditional evaluations insufficient for reflecting students' physical literacy and achievement of educational goals. Establishing a scientific evaluation system is strategically valuable for driving reforms in higher education physical education by optimizing course design and aligning with the policy of "integration of physical education and health."

1.2 Review of Domestic and International Research

Internationally, the field of physical education evaluation has a long history. Ralph W. Tyler's "Objective-Based Evaluation Model" emphasizes outcome-oriented evaluation centered on teaching objectives. Japan's "Lifetime Sports" approach integrates social adaptability and exercise habits into a diversified evaluation framework. The European Union's "Physical Literacy Assessment Model" utilizes cognitive, skill, and affective dimensions for dynamic monitoring of educational outcomes. Domestically, Wang Jian proposed a "Three-Dimensional Integrated" evaluation system encompassing knowledge, skills, and emotional attitudes, but research mainly focuses on optimizing individual indicators and lacks systematic approaches to building comprehensive evaluation systems. Moreover, there is no mature solution for leveraging AI

and big data to enhance evaluation precision and efficiency amid digital transformation.

1.3 Research Objectives and Content

This study aims to construct a university physical education course evaluation system aligned with the needs of contemporary talent development and to explore effective implementation strategies. The specific objectives include defining principles for the evaluation system based on educational evaluation theories and physical education principles, using Delphi and AHP methods to select and weight evaluation indicators, and proposing dynamic, intelligent implementation strategies in line with the development trends of "Smart Sports," thereby providing practical support for curriculum reform in higher education.

2. THEORETICAL FOUNDATIONS FOR CONSTRUCTING THE EVALUATION SYSTEM

2.1 Educational Evaluation Theories

Educational evaluation theories guide the methodology for assessing physical education courses. Bloom's Taxonomy categorizes educational objectives into cognitive, skill, and affective domains, corresponding to critical aspects of physical education, such as knowledge acquisition, technical proficiency, and sportsmanship. The CIPP evaluation model developed by Stufflebeam emphasizes a comprehensive evaluation framework from course design to effectiveness feedback. On a practical level, value-added evaluation theories focus on assessing individual progress, which can significantly enhance student participation in physical education courses.

2.2 Theories in Physical Education

Diverse theories in physical education support the development of the evaluation system. The stages of motor skill acquisition theory highlight the need for different assessment focuses at various stages. Life-long sports theory underscores the importance of fostering lifelong fitness habits, necessitating additional indicators like exercise interest and self-training ability in the evaluation framework. Zhou Dengsong's "Optimization of the Physical Education Teaching Process" theory advocates for integrating teaching, learning, practice, and assessment to enhance the synergy between evaluation systems and teaching practices.

3. CONSTRUCTION OF THE EVALUATION INDICATOR SYSTEM

3.1 Principles for Constructing the Evaluation Indicator System

The construction of the evaluation indicator system adheres to four principles: scientific validity, comprehensiveness, operability, and dynamism. An analysis of curricula from 50 universities reveals that traditional skill assessments dominate, accounting for 65%, with competencies like learning strategies and collaboration only comprising 15%. This new system emphasizes process-oriented and competency-based indicators to ensure balanced evaluation dimensions.

3.2 Screening and Determining Evaluation Indicators

The Delphi method was utilized for indicator selection, involving a consulting team of 20 experts and 15 frontline teachers through three rounds of anonymous questionnaires. The initial framework proposed five primary and 32 secondary indicators, which were refined based on expert feedback, resulting in a final system encompassing five primary indicators and 23 secondary indicators. The expert consensus rate was high, indicating a reliable indicator system.

4. DETERMINING THE WEIGHT OF EVALUATION INDICATORS

4.1 Method for Weight Determination

The Analytic Hierarchy Process (AHP) was employed to determine weights, involving a hierarchical structure construction, judgment matrix creation, and weight vector calculations to minimize subjective bias. This method is particularly suitable for complex systems with multiple dimensions and factors.

4.2 AHP for Weight Determination

A three-level hierarchical structure was built, with the top level as the evaluation system, a criterion layer with five primary indicators, and a solution layer with 23 secondary indicators. Fifteen experts utilized pairwise comparisons to assess indicator importance, achieving a consistency ratio below 0.1. The final weights were derived, with teaching effectiveness (0.32), teaching process (0.28), teaching content (0.20), teaching methods

(0.15), and teaching objectives (0.05) being the primary indicators, while secondary indicators like student progress (0.12) and classroom engagement (0.10) ranked highest, providing quantifiable evidence for evaluation practice.

5. IMPLEMENTATION PATHWAY OF THE UNIVERSITY SPORTS CURRICULUM EVALUATION SYSTEM

5.1 Establishment of a Dynamic Evaluation Mechanism

To align with the dynamic characteristics of students' physical literacy development, universities should develop a dynamic evaluation mechanism that tracks progress continuously and provides real-time feedback. Firstly, by leveraging technologies such as wearable devices and sports apps, universities can collect and analyze students' daily exercise data (e.g., duration, frequency, intensity) to create ongoing physical activity profiles. For instance, the "Sports World Campus" app implemented at a certain university automatically uploads daily running data, and the system assesses completion against set goals, contributing 20% to the overall physical education grade at semester's end, effectively encouraging students to maintain exercise habits.

Secondly, the traditional single final exam model should be broken, incorporating multiple assessment checkpoints. In skill teaching units, tests for basic, advanced, and comprehensive skills can be established; in theoretical modules, classroom quizzes and thematic discussion reports can serve as evaluation activities. Statistics show that students in multi-stage assessment sports courses improved their knowledge and skill mastery by 25%, with significant increases in learning motivation. Additionally, a dynamic monitoring mechanism for teaching efficacy should be established, regularly collecting feedback from students, teachers, and educational administrators to timely adjust content and methods, ensuring close alignment between evaluation and teaching practices.

5.2 Teacher Training Strategies

As the key implementers of the evaluation system, teachers' professional competence directly impacts evaluation quality. Universities should develop a tiered training system for teachers: for newly hired educators, foundational training on educational evaluation theory and sports curriculum standards should be provided to help them grasp basic evaluation principles and methods. In a specific university's new teacher training, a week-long specialized course on sports teaching evaluation was conducted, covering Bloom's Taxonomy and the CIPP evaluation model, resulting in a 35% increase in new teachers' accurate understanding of evaluation indicators post-training.

For experienced teachers, training should focus on cutting-edge evaluation technologies (e.g., big data analysis, AI-assisted evaluation) and new concepts in sports education (e.g., integrating ideological education into the curriculum). Inviting industry experts for lectures and organizing academic seminars will enhance their knowledge and skills. Moreover, a mechanism for assessing teachers' evaluation capabilities should be established, including evaluation implementation outcomes in teaching performance assessments, motivating teachers to enhance their evaluation competencies and ensuring effective execution of the evaluation system.

5.3 Application of Information Technology

In the era of "Internet + Education," information technology empowers sports curriculum evaluation. On one hand, a smart evaluation platform for sports courses should be built, integrating data on students' physical health, course learning records, and extracurricular sports activities, utilizing data mining and machine learning algorithms for automatic calculation and analysis of evaluation indicators. For instance, Tsinghua University developed the "Tsinghua Sports" platform that models and analyzes years of student physical fitness data to accurately assess trends in physical development, providing data support for personalized teaching.

On the other hand, innovative evaluation methods should be pursued using virtual reality (VR) and augmented reality (AR) technologies. In skill assessments, VR can simulate sports scenarios for objective evaluation of students' movement accuracy and adaptability; AR devices can provide real-

time feedback and correction for sports techniques. Related experiments indicate that students using VR/AR-assisted evaluation saw an average increase of 10 points in skill assessment scores, with a 40% improvement in efficiency in mastering complex movements, significantly enhancing the precision and engagement of evaluations, thus promoting the intelligent and digital transformation of sports course evaluations.

6. CONCLUSION

This study establishes a university sports curriculum evaluation system encompassing five primary indicators—teaching objectives, content, methods, processes, and outcomes—along with 23 secondary indicators, using the Analytic Hierarchy Process (AHP) to determine indicator weights. The implementation pathway includes establishing a dynamic evaluation mechanism, conducting tiered teacher training, and applying information technology to ensure effective realization of the evaluation system. The research demonstrates that the new evaluation system overcomes traditional models that prioritize outcomes over processes and rely on a single evaluation subject, offering a comprehensive and objective reflection of teaching quality to support reforms in higher education sports teaching.

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Analysis of Teaching Effectiveness in Public English Classes in Higher Education under New Economic Models

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Abstract: The rapid advancement of digital technology and transformation of educational models pose both challenges and opportunities for public English instruction in higher education. This study systematically analyzes the teaching effectiveness of public English classes under new economic models. Utilizing bibliometric analysis, educational data mining, and statistical modeling, we first clarify the current trends and theoretical frameworks in public English teaching research through a comprehensive review of relevant literature. Next, we conduct an in-depth quantitative analysis of teaching process data, student performance, and teaching evaluations from multiple institutions, employing structural equation modeling to explore the pathways through which variables such as teaching environment, instructional model, and student engagement impact teaching effectiveness. Additionally, we use comparative analysis to examine the differences in teaching outcomes between traditional and new economic instructional models. Results indicate that the appropriate use of smart teaching tools, optimization of blended learning models, and enhancement of students' autonomous learning abilities significantly improve teaching effectiveness. Factors such as the adaptability of teaching resources and teachers' digital teaching competencies also play a moderating role. This study provides a theoretical basis and practical reference for enhancing the quality of public English instruction in higher education under new economic paradigms.

Keywords: New Economic Models; Public English in Higher Education; Teaching Effectiveness; Teaching Models; Smart Teaching

1. INTRODUCTION

1.1 Background and Significance

In the era of rapid digital economic development, education is undergoing unprecedented transformations. New economic models are reshaping the teaching ecology of public English classes in higher education at an unprecedented speed. The Ministry of Education's "Education Informatization 2.0 Action Plan" emphasizes the deep integration of information technology with education, driven by the accelerated incorporation of artificial intelligence, big data, and virtual reality throughout the teaching process. According to a 2023 survey by the Chinese Higher Education Association, 92% of universities have adopted at least one smart teaching tool, with 78% implementing blended learning practices, shifting instructional contexts from single physical spaces to diverse online-offline environments. As a foundational course for cultivating international talents, the effectiveness of public English instruction directly influences students' cross-cultural communication skills and global competitiveness. However, while new economic models enhance teaching efficiency, they also contribute to issues such as homogenization of teaching and weakened student-teacher interaction. Research indicates that some public English classes have achieved full technological coverage, yet student autonomous learning completion rates remain below 60%, with classroom participation decreasing by 15% compared to traditional models. Therefore, systematically analyzing the mechanisms influencing teaching effectiveness and exploring pathways for quality improvement is essential—not only for the development of the courses themselves but also for meeting the urgent need to cultivate innovative talents with international perspectives in line with national

"New Liberal Arts" strategies.

1.2 Review of Current Research

Internationally, research on language teaching under new economic models has progressed rapidly, focusing on innovations in technology-enabled instructional models. For instance, the TPACK framework proposed by the International Society for Technology in Education (ISTE) emphasizes the integration of technology, pedagogy, and content knowledge. The European Union's "Digital Education Action Plan" utilizes big data analytics to optimize language learning pathways. However, these studies often overlook local factors such as cultural differences and educational systems.

Domestically, research shows multidimensional characteristics encompassing smart classroom construction and blended teaching practices. Scholars like Wang Qiang have proposed the "dual-circulation" teaching model, emphasizing the suitability of technological tools for specific teaching goals. Conversely, Li Zhanzai's team has created immersive language learning environments using metaverse technologies. Nevertheless, existing studies have three major limitations: first, they often focus on the effects of singular technological applications without comprehensive analysis; second, quantitative research comprises only 38% of the literature (as per CNKI statistics from 2020-2024), indicating insufficient depth in exploring influencing mechanisms; third, evaluations of teaching effectiveness primarily rely on traditional performance metrics, failing to fully address the competency development needs under new economic models.

2. CORE CONCEPTS AND THEORETICAL FOUNDATIONS

2.1 Definition and Characteristics of New Economic Models

New economic models in education are characterized by digital technology as the core driving force, restructuring educational elements, processes, and paradigms. Key features include:

Deep integration of technology, with innovations such as 5G and blockchain breaking temporal and spatial teaching limitations, creating an integrated "cloud-network-end" teaching environment.

Innovative models emerging from learning analytics such as precision teaching and contextualized learning based on virtual reality.

Ecological restructuring, shifting from institution-led education services to collaborative efforts among diverse stakeholders, forming a fully digitized ecosystem encompassing teaching, learning, evaluation, and management. The "2024 Development Report on New Educational Economic Models" indicates that the scale of the educational technology market has surpassed 800 billion RMB, with online education users reaching 430 million, covering the entire teaching cycle.

2.2 Theoretical Frameworks Related to Public English Teaching

Sociocultural theory provides crucial support for English Teaching under new economic models. Vygotsky's "Zone of Proximal Development" emphasizes the facilitative role of learning environments in language abilities development, aligning with the personalized learning concepts enabled by new economic models. Furthermore, constructivist theory advocates for learners to actively build their knowledge framework, facilitated by collaborative learning platforms and intelligent feedback systems under new economic paradigms. From a language teaching perspective, task-based and project-based learning methodologies have been deepened within smart classrooms, effectively enhancing students' language application abilities by integrating authentic materials and digital resources.

3. RESEARCH DESIGN AND METHODS

3.1 Research Subjects and Data Sources

This study selected public English courses from 30 higher education institutions of varying levels across China, including "Double First-Class" universities, regular undergraduate colleges, and vocational institutions. Data collection consisted of three parts: teaching process data from platforms like Super Star Learning and Rain Classroom, covering behavior data from over 3,000 teaching classes; student performance data from midterm and final assessments for the 2022-2024 academic years; and teaching

evaluation data collected through questionnaires, resulting in 5,280 valid responses, including 870 from teachers and 4,410 from students.

3.2 Research Methods and Technical Approach

A mixed-methods research design was employed. Quantitative analysis utilized SPSS 26.0 for descriptive statistics and correlation analysis, constructing structural equation models to explore causal relationships among variables. Qualitative analysis used NVivo 12 to code interview transcripts from teachers and students to extract key influencing factors. The technical approach followed a logical sequence of "theoretical construction-data collection-model validation-strategy formulation," initially establishing a model of factors influencing teaching effectiveness based on literature review, validating the model through data mining, and ultimately proposing optimization strategies based on the analysis results.

4. CURRENT STATUS OF PUBLIC ENGLISH INSTRUCTION IN HIGHER EDUCATION UNDER NEW ECONOMIC MODELS

4.1 Teaching Environment and Resource Availability

The teaching environment exhibits characteristics of digitization and intelligence. In terms of hardware, 85% of classrooms are equipped with smart boards and recording systems; regarding software platforms, 72% of institutions have developed or procured specialized English teaching systems. However, there are significant regional disparities, with smart classroom coverage reaching 91% in eastern universities compared to only 63% in western institutions. Educational resources are beginning to take shape, with over 1,200 high-quality public English courses included in the national smart education public service platform and more than 50,000 micro-video resources available. However, resource homogenization is severe; duplicate rates for similar-themed courses have reached 42%, while resources tailored to vocational scenarios and industry demands constitute less than 18%.

4.2 Application of Teaching Models

Blended learning has become the mainstream model, with 89% of universities employing an "online self-learning + offline in-depth discussion" approach. In practice, online platforms primarily serve knowledge dissemination roles (76%), while offline classes focus on language practice and interaction (24%). However, issues with superficial application persist; surveys show only 35% of teachers can effectively design integrated online-offline activities, and 62% of students feel online learning lacks targeted guidance. Additionally, the adoption of AI-assisted teaching is gradually increasing, with intelligent essay grading systems used at a rate of 68%, yet the accuracy of speech recognition error correction remains at only 79%, still falling short of practical teaching needs.

5. ANALYSIS OF FACTORS INFLUENCING TEACHING EFFECTIVENESS

5.1 Role of Intelligent Teaching Tools

In the context of public English teaching in higher education under new circumstances, intelligent teaching tools have become indispensable, significantly impacting teaching effectiveness. From a hardware perspective, the widespread adoption of smart blackboards has largely overcome the limitations of traditional chalkboards. These tools facilitate high-definition displays of diverse teaching resources, including multimedia materials such as videos, audio, and images, while allowing teachers to annotate and highlight content, thus enhancing the visual and interactive aspects of teaching. For instance, when explaining complex grammatical structures in English texts, teachers can use animations to present abstract rules dynamically, aiding student comprehension. Research indicates that the use of smart blackboards has led to an average improvement of 15% in students' understanding of grammatical concepts [7]. The presence of recording systems enables reviewing and reflecting on teaching practices, allowing educators to analyze aspects such as pacing and student engagement for targeted pedagogical adjustments. Moreover, students can revisit key classroom content, bridging potential gaps in understanding. Data from a public English course at a certain university revealed that the introduction of a recording

system improved students' mastery of course content by 12 percentage points in final assessments [8].

In terms of software platforms, various specialized English teaching systems offer extensive functional support for teaching activities. Vocabulary learning software employs gamification and challenge-based designs to stimulate student engagement. For example, Baicizhan utilizes image association techniques to help students memorize vocabulary effectively while having fun. Studies show that students using such software have increased vocabulary retention by 20% compared to traditional memorization methods [9]. Intelligent essay grading systems play a crucial role in writing instruction, rapidly correcting grammatical errors, assessing vocabulary richness, and analyzing text structure. However, current systems still experience limitations in semantic understanding, with approximately 25% of semantic errors going unrecognized [10]. The voice recognition error correction feature, while widely used for oral practice, has a 79% accuracy rate, restricting its capability to fully address student pronunciation issues and meet detailed instructional needs. Additionally, significant disparities exist in the configuration and use of intelligent teaching tools across educational institutions in different regions and tiers. Universities in economically developed eastern regions can afford timely updates and upgrades, while some institutions in the western areas face tight budgets, outdated equipment, and low software versions, adversely affecting teaching outcomes.

5.2 Influence of Teaching Models and Student Factors

Although blended learning models have become mainstream, several challenges have emerged during implementation. In the online autonomous learning phase, the lack of effective supervision mechanisms leads to notable variations in student independence and self-discipline. Some self-motivated students can efficiently manage their learning time and fully utilize online resources for in-depth study, while others may be easily distracted, resulting in fragmented learning and diminished focus. Statistics indicate that about 40% of students interrupt their online English learning due to engaging with unrelated web pages or responding to messages [11]. This inconsistency directly impacts the quality of subsequent offline interactions and discussions. In offline classrooms, despite teachers' attempts to foster language practice through group discussions and role plays, the disconnection between online and offline segments often hinders students from effectively applying their online knowledge. For example, during discussions on topics related to online courses, 30% of students exhibit forgetfulness or superficial understanding of the material, complicating deeper discussions [12].

Students' intrinsic factors also significantly influence teaching effectiveness. There is a substantial disparity in students' foundational knowledge of English, particularly evident in public English classes. Students with stronger foundations adapt quickly to the new teaching pace and actively participate in various activities, thus enhancing their language skills. Conversely, students with weaker foundations may feel overwhelmed by extensive online tasks and complex content, diminishing their motivation. In the final exam of public English courses, 80% of students scoring above 85 had solid English foundations, while over 75% of those scoring below 60 struggled with foundational knowledge [13]. Furthermore, students' learning motivation plays a critical role; those with clear goals (e.g., studying abroad, participating in English competitions) are more inclined to invest time and effort in their studies, often outperforming less motivated peers. A study on university students' English learning motivation found that students driven by intrinsic motivation scored, on average, 8 points higher in comprehensive English assessments compared to those motivated by external factors [14]. Additionally, students' adaptability to new teaching models varies, with some quickly adjusting while others take longer or struggle, which can limit improvements in teaching effectiveness.

6. STRATEGIES AND RECOMMENDATIONS FOR ENHANCING TEACHING EFFECTIVENESS

6.1 Strategies for Optimizing Teaching

Models

To address superficiality in blended teaching models, there is a need for a deeper design of integrated online and offline activities. During the online learning phase, teachers should create detailed learning guides based on course content and student needs, clearly defining objectives, tasks, and timelines. For instance, prior to each unit's online learning, teachers could distribute learning packages containing preview videos, reading materials, and assignments, requiring students to complete and submit them by specified deadlines. Utilizing the monitoring features of learning platforms can help track student progress in real time, allowing for timely reminders and guidance for those lagging behind or showing low engagement. In offline classrooms, teachers should design diverse practical activities centered around online content. For example, organizing group projects that require students to apply online knowledge in English research presentations or short performances can translate theoretical knowledge into practical language skills. Throughout these projects, teachers should provide ongoing guidance, regularly check group progress, and promptly address challenges to facilitate effective collaboration. Furthermore, to enhance the relevance of online learning, teachers can leverage learning analytics to deeply analyze student behavior data, identifying habits and knowledge gaps to provide personalized recommendations and resources. For instance, students struggling with vocabulary can receive targeted reinforcement materials, while those needing improvement in reading comprehension can be recommended relevant instructional videos and supplementary reading materials.

To fully leverage the advantages of AI-assisted teaching, continuous improvement of intelligent teaching tools is essential. For intelligent essay grading systems, development teams should focus on optimizing semantic understanding algorithms and incorporate deep learning technologies to enhance the accuracy and logic assessment of student essays. Additionally, implementing a human review process for essays flagged by the system can ensure the reliability of grading results. In the voice recognition error correction feature, expanding the voice sample library to include diverse accents and speaking speeds can improve the system's recognition accuracy. Moreover, developing real-time feedback capabilities can provide immediate correction prompts and model correct pronunciations during students' oral practice, aiding timely improvement.

6.2 Recommendations for Enhancing Teaching Resources and Teacher Competence

To address the homogenization of teaching resources, higher education institutions and educational organizations should enhance the development of distinctive resources. On one hand, teachers are encouraged to create targeted public English teaching materials that align with their institution's specialties and student needs. For instance, engineering schools might develop English resources related to engineering technology and international academic exchanges, while finance-related institutions could design specialized courses in financial English and business negotiation English. On the other hand, strengthening collaborations between schools and enterprises to integrate real industry projects and case studies into teaching resources is vital. Collaborations with foreign trade companies to obtain authentic business emails, contract documents, and other materials can enrich students' understanding of real-world applications while learning English. Additionally, establishing a resource-sharing and evaluation mechanism can promote the circulation and dissemination of high-quality resources. By creating a resource evaluation indicator system that assesses the practicality, innovation, and effectiveness of teaching materials, institutions can reward creators of high-quality resources, encouraging greater investment in resource development by educators.

As organizers and facilitators of teaching activities, teachers' competencies directly affect teaching outcomes. In the new context, teachers must possess information technology application skills, instructional design capabilities, and cross-cultural communication proficiency. Institutions should enhance teacher training by regularly offering courses on technology application,

such as smart teaching tool training and platform operation workshops, to improve educators' ability to integrate technology into their teaching. Furthermore, organizing teaching seminars with experts and outstanding educators can foster knowledge exchange and learning among faculty members. For example, conducting workshops on designing blended teaching models can help teachers master methods for integrating online and offline activities through practical experience. Additionally, encouraging teachers to participate in international academic exchanges can broaden their global perspectives and enhance their cross-cultural communication skills, better preparing them to cultivate students' international competencies in their teaching. Teachers should also adopt a lifelong learning mindset, staying abreast of developments in the education sector, continuously updating their pedagogical concepts, and enhancing their professional abilities to meet the demands of public English teaching in higher education under new circumstances.

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Challenges and Pathways for Reform in the Dual-Dimension Teaching of Ideological and Political Education and Aesthetic Education in Physical Education Courses at Vocational Colleges

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Abstract: This study explores the challenges and pathways for reforming the dual-dimension teaching of "Ideological and Political Education + Aesthetic Education" in physical education courses at vocational colleges, aiming to enhance the quality of talent cultivation in vocational education. Utilizing literature review, systematic analysis, and logical induction methods, the research first summarizes the theoretical achievements of integrating ideological and political education with aesthetic education both domestically and internationally. It then analyzes the practical difficulties faced in the dual-dimension teaching reform specific to physical education courses. Findings indicate issues such as insufficient integration of teaching objectives, lack of systematic content integration, inadequate faculty capabilities, and an incomplete evaluation system. To address these challenges, the study proposes pathways including the construction of a collaborative educational objective system, the design of deeply integrated teaching content, enhancement of faculty development, and the refinement of a diversified evaluation mechanism. This approach aims to achieve an organic integration of ideological and political education with aesthetic education within physical education courses, ultimately establishing a dual-dimension teaching model characteristic of vocational education. The conclusions provide theoretical references and practical guidance for the reform of physical education course teaching, contributing to the overall development of vocational education in terms of value shaping and aesthetic cultivation.

Keywords: Vocational Education; Physical Education; Ideological and Political Education; Aesthetic Education; Teaching Reform

1. INTRODUCTION

1.1 Research Background and Significance

Driven by the strategy for high-quality development in vocational education, undergraduate vocational education serves as a crucial link between vocational and general education, tasked with cultivating high-quality applied talents. The "Implementation Plan for National Vocational Education Reform" emphasizes the need to deepen the integration of production and education, strengthen the combination of moral education and technical skills, and promote collaborative educational mechanisms. In this context, the collaborative advancement of ideological education and aesthetic education has become essential to fulfill the mission of moral character development. As a vital component of the humanities courses in undergraduate vocational education, physical education not only shapes students' physical demeanor and enhances artistic expression but also possesses significant potential for value guidance. The Ministry of Education's guidelines on enhancing aesthetic education highlight its role in nurturing creativity and imagination, thus stimulating innovation. Integrating ideological and aesthetic education into physical education responds to national educational policy and promotes innovation in the vocational curriculum, which is crucial for

cultivating well-rounded professionals.

From a social demand perspective, the current industrial upgrade necessitates higher comprehensive quality among vocational talents. Survey data reveals that 78% of employers include soft skills such as professional ethics and teamwork in core recruitment criteria, while the traditional single-mode physical education has become inadequate to meet these training requirements. The "Ideological + Aesthetic" dual-dimensional teaching reform can incorporate elements like professional spirit, cultural confidence, and aesthetic interest into physical training, helping students develop a well-rounded personality and professional qualities. From an educational practice standpoint, this dual-dimensional reform can break down disciplinary barriers and establish a comprehensive educational system, providing a new practical paradigm for vocational education curriculum reform and significantly contributing to improving the quality of undergraduate vocational talent cultivation.

1.2 Literature Review

Internationally, research on value education and aesthetic cultivation in vocational education has a longer history. Germany's "dual system" education emphasizes the integration of professional ethics and craftsmanship by combining enterprise training and school instruction, embedding vocational values throughout skills training. In the U.S., vocational education highlights "Career and Technical Education (CTE)," achieving synergetic development of vocational competencies and humanities skills through interdisciplinary curriculum design. In the realm of aesthetic education, Ronfield's "instrumental theory" underscores the role of art in personality development, providing a theoretical foundation for aesthetic practices in vocational education. However, existing studies often focus on a single dimension and lack a systematic exploration of the collaborative mechanism between ideological and aesthetic education.

Domestically, following the 2016 National Conference on Ideological and Political Work in Universities that proposed the "curriculum ideology and politics" concept, related research has grown rapidly. In vocational education, scholars have discussed implementation pathways and evaluation systems for curriculum ideology, yet research specifically targeting physical education remains limited. Some studies suggest integrating aesthetic education into professional skills training, as seen in fashion design courses enhancing students' artistic creativity, but the dual-dimensional collaborative mechanism in physical education requires further investigation. Current findings largely remain theoretical, lacking practical exploration tailored to the characteristics of undergraduate vocational physical education, and necessitate the establishment of teaching reform models that align with vocational education principles.

1.3 Research Objectives and Methods

This study aims to analyze the practical challenges of the "Ideological + Aesthetic" dual-dimensional teaching reform in undergraduate vocational physical education, explore pathways for systematic breakthroughs, and develop an actionable teaching reform plan. The research employs a combination of literature review, questionnaire surveys, and interviews: analyzing relevant literature to clarify the research status and theoretical foundations; surveying 32 institutions offering physical education courses, collecting 586 valid responses from teachers and students; and conducting in-depth interviews with 10 representative institutions to gather frontline teaching practice data. Statistical analysis of the survey data will be conducted using SPSS 26.0, complemented by qualitative research methods to identify reform challenges and propose targeted strategies, ensuring the scientific and practical relevance of the research conclusions.

2. THEORETICAL FOUNDATION OF THE "IDEOLOGICAL + AESTHETIC" DUAL-DIMENSIONAL TEACHING REFORM IN UNDERGRADUATE VOCATIONAL PHYSICAL EDUCATION

2.1 Conceptual Definitions

Undergraduate vocational education is a higher-level educational type within the vocational education system, aiming to cultivate high-quality applied talents that meet the needs of industrial transformation and upgrading, emphasizing the deep integration

of theoretical knowledge and practical skills. Physical education focuses on enhancing students' physical aesthetics and artistic cultivation through training in body posture, dance choreography, and artistic expression. The "Ideological + Aesthetic" dual-dimensional teaching refers to the organic integration of ideological education's value guidance and aesthetic education's nurturing function within physical education, achieved through the reconstruction of course objectives, content, and teaching methods to enable the synergistic development of knowledge transfer, skill development, and value shaping. Ideological education emphasizes guidance on professional spirit and socialist core values, while aesthetic education focuses on cultivating aesthetic perception, artistic creativity, and humanistic sentiment.

2.2 Theoretical Basis

Constructivist learning theory underscores the active construction of knowledge and value systems by learners in context, providing a cognitive foundation for dual-dimensional teaching. In physical education, creating professional and artistic contexts guides students in internalizing ideological and aesthetic elements through practice. The theory of multiple intelligences posits various types of human intelligence—including linguistic, spatial, and interpersonal—supporting the multidimensional design of teaching content, such as fostering spatial intelligence through dance choreography and interpersonal intelligence through teamwork projects. Moreover, General Secretary Xi Jinping's important discourse on "whole-person education" provides policy guidance for the collaborative advancement of ideological and aesthetic education, calling for the integration of ideological education throughout the educational process to achieve comprehensive, all-around talent development.

3. NECESSITY OF THE "IDEOLOGICAL + AESTHETIC" DUAL-DIMENSIONAL TEACHING REFORM IN UNDERGRADUATE VOCATIONAL PHYSICAL EDUCATION

3.1 Talent Development Needs in Vocational Education

In the context of digital transformation, the structure of vocational talent demand has undergone profound changes. Data from the China Employment Training Technical Guidance Center indicates a 32% gap for composite talents who possess both professional skills and humanistic qualities in emerging job roles. For instance, in the aviation service industry, employers require not only standard physical etiquette but also cultural depth and service awareness. The dual-dimensional teaching reform can integrate elements such as craftsmanship spirit and professional ethics, as well as Chinese aesthetic spirit and artistic appreciation, into physical education, enhancing students' comprehensive competitiveness in professional contexts. For example, integrating traditional etiquette culture into hotel service physical training not only enhances students' professional skills but also strengthens their cultural confidence and service awareness.

3.2 Development Needs of the Course

Traditional physical education courses face issues such as singular teaching content and an emphasis on skills over quality. Surveys reveal that 65% of students believe the existing courses lack cultural depth, and 43% of teachers report insufficient alignment between teaching objectives and vocational demands. The "Ideological + Aesthetic" dual-dimensional reform can expand the educational function of the course by exploring cultural symbols and values in physical training, such as the national spirit in classical Chinese dance and the innovation consciousness in modern dance, enriching the teaching content system. Additionally, dual-dimensional teaching emphasizes innovative teaching methods, employing situational teaching and project-based learning to stimulate student interest and transition physical education from a focus on skills to comprehensive quality development.

4. PRACTICAL CHALLENGES OF THE "IDEOLOGICAL + AESTHETIC" DUAL-DIMENSIONAL TEACHING REFORM IN UNDERGRADUATE VOCATIONAL PHYSICAL EDUCATION

4.1 Insufficient Integration of Teaching Objectives

Most institutions still utilize a "skill-oriented"

approach in setting physical education objectives, failing to adequately reflect the educational requirements of ideological and aesthetic dimensions. Survey data indicates that only 28% of institutions explicitly define ideological and aesthetic objectives in their physical education standards, and many of these objectives remain at a slogan level, lacking operational feasibility. For example, some institutions list "cultivating patriotism" as an ideological goal but fail to effectively connect it with physical training content, resulting in a superficial implementation of value guidance. Furthermore, the lack of collaborative design among ideological, aesthetic, and skill objectives hinders the creation of a coherent, supportive objective system, affecting the overall effectiveness of teaching.

4.2 Lack of Systematic Integration of Teaching Content

Current physical education content exhibits a fragmented nature, with insufficient systematic design for integrating ideological and aesthetic elements. On one hand, cultural knowledge and skill training are disconnected; for instance, ballet training focuses solely on technical execution while neglecting the cultural values behind the art. On the other hand, the selection of ideological elements can be arbitrary, with some teachers simplifying ideological education to case studies without in-depth exploration related to physical education. Additionally, the content is often outdated and fails to incorporate contemporary professional ethics and elements of excellent traditional Chinese culture, making it difficult to meet students' cognitive needs and industry development demands.

4.3 Need for Enhanced Teacher Competencies

Teachers are key implementers of dual-dimensional teaching reforms, yet the current physical education faculty faces competency gaps. Survey data indicates that 72% of physical education teachers have not received systematic training in ideological education and aesthetic education, lacking the ability to integrate ideological elements and unfamiliar with aesthetic teaching methods. Some teachers continue to use traditional demonstration methods, making it challenging to achieve a cohesive integration of ideological and aesthetic elements. Furthermore, mechanisms for interdisciplinary collaboration among faculty remain undeveloped, leading to a lack of cooperation and resource integration between ideological and physical education teachers, thereby impeding the advancement of dual-dimensional teaching reforms.

4.4 Inadequate Evaluation System

The current evaluation of physical education courses primarily focuses on skill assessment, lacking effective evaluation of the attainment of ideological and aesthetic objectives. Evaluation methods are often singular, commonly adopting a combination of classroom performance and final assessments, while lacking process-oriented evaluations and diverse stakeholder participation. For example, in dance choreography project evaluations, attention is primarily given to the complexity of movements and technical execution, neglecting the reflection of innovative thinking and value orientation within the work. Additionally, evaluation criteria are often vague, with a lack of scientific methods for quantifying indicators such as ideological literacy and aesthetic ability, leading to insufficient feedback for teaching improvement and affecting the sustainability of dual-dimensional teaching reforms.

5. PATHWAYS FOR BREAKTHROUGHS IN DUAL-DIMENSIONAL TEACHING REFORM OF IDEOLOGICAL AND POLITICAL EDUCATION AND AESTHETIC EDUCATION IN HIGHER VOCATIONAL PHYSICAL EDUCATION COURSES

5.1 Constructing a Collaborative Educational Goal System

Teaching objectives serve as the core guidance for course implementation. To address the insufficient integration of teaching goals in current higher vocational physical education courses, we propose a collaborative educational goal system structured around "Value Guidance-Aesthetic Formation-Skill Enhancement." First, the ideological goal should align closely with occupational requirements and socialist core values. For example, in physical courses for aviation

service, incorporate "safety responsibility" and "international image representation" into posture training, ensuring students display professional standards and national image through their body language. In hotel management courses, focus on fostering a "spirit of service," reinforcing professional ethics through banquet etiquette training.

Second, aesthetic goals should emphasize the cultivation of aesthetic ability and cultural confidence. Following the guidelines of the "Opinions on Strengthening and Improving Aesthetic Education in the New Era," we suggest setting objectives such as "Analysis of Aesthetic Characteristics of Western Ballet" in ballet courses, and incorporating the "Cultural Value Interpretation of Traditional Chinese Dance" in ethnic dance courses, guiding students to understand the cultural connotations behind artistic training. Skill objectives should resonate with the former two, such as requiring students to master movement design techniques while conveying correct values through thematic expression in dance creation, thereby unifying skill training and value shaping.

During the goal system construction, employ the OBE (Outcome-Based Education) concept for reverse design. Through in-depth industry research, clarify the competency requirements for talent in various professions, converting them into observable and evaluable specific goals. For instance, in the cultural tourism industry, surveys indicate that 82% of enterprises require employees to possess cultural communication skills and teamwork spirit; thus, additional indicators like "Cultural Expression Ability in Cultural Tourism Scenarios" and "Team Collaboration Skills in Artistic Projects" can be integrated into physical education objectives to ensure alignment with industry demands.

5.2 Designing Deeply Integrated Teaching Content

Deeply integrated teaching content is the key medium for achieving the dual-dimensional teaching of ideological and political education and aesthetic education. The content design should transcend the traditional framework of skill training, constructing a tripartite system of "Cultural Core-Artistic Expression-Professional Application." First, explore the cultural genes within physical education courses, deeply embedding outstanding traditional Chinese culture and vocational spirit into the curriculum. In classical dance instruction, introduce cultural origins from "Zhou Li" regarding the "Six Arts Dance" and explain the philosophical ideas behind Chinese classical dance postures, such as "Unity of Nature and Humanity." In modern dance creation, relate students' expression of the "craftsman spirit" through body language to embody the spirit of contemporary laborers.

Second, innovate the presentation of teaching content using project-based learning (PBL) and situational teaching methods to organically merge ideological and political education with aesthetic education. For example, design a "Belt and Road Cultural Exchange Exhibition" project requiring students to exhibit artistic characteristics of countries along the route through physical performance, incorporating cross-cultural understanding and inclusivity into movement arrangement; create "Red-themed Dance Creation" scenarios where students research revolutionary history to transform elements like the Long March spirit into dance vocabulary, reinforcing ideological education through artistic creation.

Third, establish a dynamic updating mechanism to incorporate industry trends and social hotspots into teaching content. Given the rising application of metaverse technology in the cultural tourism sector, add a module on "Physical Expression Techniques in Virtual Scenarios" to encourage students to contemplate the ethical boundaries of artistic expression in the digital age. In alignment with rural revitalization strategies, develop a thematic focus on "Local Cultural Physical Creation," allowing students to enhance their sense of cultural inheritance by exploring local intangible cultural heritage dance resources. Continuous updates ensure the curriculum remains relevant and vital.

5.3 Strengthening Faculty Development

The faculty is the core force behind the implementation of teaching reform. To address current issues of insufficient teacher capabilities and lack of collaborative mechanisms, a "Tiered Training-Cross-Disciplinary Collaboration-Incentive Assurance" teacher development system should be constructed. First, conduct tiered

and classified training to enhance teachers' dual-dimensional teaching abilities. For physical education faculty, offer specialized training on "Extracting Ideological Elements and Teaching Design" and "Innovative Aesthetic Teaching Methods," inviting experts in ideological education and art education to collaborate in instruction. For ideological teachers, organize workshops on "Physical Art and Aesthetic Education Practice" to help them grasp the principles of art education. Training should emphasize practical orientation through workshops and case studies to improve teachers' ability to integrate ideological and aesthetic education into physical teaching.

Second, establish a cross-disciplinary collaboration mechanism to promote deep cooperation among ideological educators, aesthetic educators, and physical education teachers. Form a "Course Ideology + Aesthetics" teaching innovation team to jointly develop teaching resources and design instructional plans. For instance, in developing a "Etiquette Culture and Professional Ethics" course, ideological teachers would focus on extracting ethical norms from traditional culture, aesthetic educators would guide artistic expression forms, and physical educators would design training methods, achieving deep integration of teaching content through teamwork. Additionally, utilize digital platforms to create teacher exchange communities, encouraging the sharing of teaching experiences and collaborative research activities to facilitate cross-disciplinary knowledge sharing and integration.

Finally, improve the teacher incentive and assurance mechanisms to stimulate faculty participation in teaching reform. Integrate dual-dimensional teaching reform achievements into teacher evaluation systems, rewarding those who develop exemplary teaching cases or win teaching competition awards; establish a special teaching reform project fund to support research and practice explorations; and develop teacher growth portfolios to track improvements in ideological and aesthetic teaching capabilities, providing a basis for faculty promotion and evaluation. Through institutional guarantees and incentive measures, cultivate a positive atmosphere for teaching reform.

5.4 Improving a Diverse Evaluation Mechanism

A scientific evaluation mechanism is vital for the sustained advancement of teaching reform. To address issues of a single evaluation system and vague standards, it is necessary to construct a "Three-dimensional-Multi-entity-Whole Process" diverse evaluation mechanism. In evaluation dimensions, introduce indicators for assessing ideological literacy and aesthetic ability. Ideological literacy evaluation can be based on professional values, social responsibility, and cultural identity, using methods such as behavioral observation and work analysis. For instance, assess students' professional values through their collaborative performance in team projects and evaluate their social responsibility through thematic expression in dance works. Aesthetic ability evaluation should encompass three levels: artistic perception, appreciation, and creation, employing performance evaluation tools to quantify students' artistic expressiveness and aesthetic judgment during physical training.

In terms of evaluation entities, a multi-participation mechanism should be introduced. In addition to teacher evaluations, include student self-evaluations, peer evaluations, and evaluations by industry experts. Student self and peer evaluations can utilize "growth portfolios" to document reflections and progress throughout their learning process; industry experts can assess students' physical performance and value transmission capabilities in simulated occupational scenarios. For example, invite etiquette trainers from airlines to evaluate students' professional demeanor and service consciousness in aviation service physical education courses.

Regarding evaluation methods, implement a dynamic evaluation throughout the process. Combine formative and summative evaluations to establish a chain of assessment encompassing "pre-class preparation-classroom performance-post-class practice-project outcomes." Use online tests before class to verify students' preparation of cultural knowledge; in-class observations to record student participation and value expression; assign practical tasks post-class, such as

filming short videos on "Moments of Aesthetic Education in Life," to evaluate aesthetic application abilities; and assess project outcomes based on innovation, thematic depth, and artistry. By establishing a diverse evaluation mechanism, a comprehensive and objective assessment of teaching effectiveness can be achieved.

6. CONCLUSION

The dual-dimensional teaching reform of ideological and political education and aesthetic education in higher vocational physical education courses is an inevitable choice to fulfill the fundamental task of moral education and meet the demands of industrial upgrading. This study systematically analyzes the challenges faced in reform, such as insufficient integration of teaching goals, fragmented content integration, faculty capability gaps, and imperfect evaluation systems. Targeted suggestions include constructing a collaborative educational goal system, designing deeply integrated teaching content, strengthening faculty development, and improving a diverse evaluation mechanism. The research indicates that the dual-dimensional teaching reform should be industry-demand-oriented, achieving deep integration of ideological education, aesthetic education, and physical skill training through goal alignment, content reconstruction, faculty empowerment, and evaluation innovation, thus cultivating high-quality applied talents with professional skills, aesthetic literacy, and strong values.

Future research could further deepen practical explorations of teaching reform, validating the effectiveness of reform pathways through action research. It is also crucial to pay attention to the impact of new technologies on teaching modes, exploring the application scenarios of artificial intelligence and virtual reality in dual-dimensional teaching, providing more forward-looking theoretical and practical references for vocational education curriculum reform.

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Application and Innovation of Piano Teaching Methods in Music Education

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Abstract: This study explores the application and innovation of piano teaching methods in music education, aiming to enhance educational quality and effectiveness. A literature review systematically traces the development, current status, and challenges of piano teaching methods both domestically and internationally. By integrating theories from music education, psychology, and educational technology, the research analyzes innovative paths and practical strategies for piano teaching. Findings suggest that innovation in piano teaching should focus on personalized instruction, development of multiple intelligences, integration of technology and art, and enhancement of teacher professionalism.

Keywords: Piano teaching methods; Music education; Application and innovation; Personalized instruction; Development of multiple intelligences.

1. INTRODUCTION

1.1 Research Background and Significance

Contemporary music education is undergoing a paradigm shift, driven by the integration of technologies like artificial intelligence and virtual reality, which reshape traditional teaching contexts. Globalization and cultural awareness impose new cross-cultural interpretative demands on educational content. As a primary instrument in music education, piano teaching methods significantly influence the quality and direction of musical talent development. Traditional methods, centered on master-apprentice relationships and skill training, effectively enhance technical proficiency but are limited in cultivating musical aesthetics, creativity, and cultural understanding. The overemphasis on quick and precise grading systems often leads to a neglect of musical expressiveness and cultural literacy. Furthermore, the digital era necessitates teaching methods that transcend spatial and temporal limitations, fostering immersive and interactive learning environments.

The theoretical significance of this study lies in constructing a systematic theoretical framework that meets modern music education needs through interdisciplinary perspectives. Practically, it aims to promote the professionalization and internationalization of music education by optimizing resource allocation through technological innovation, enhancing cultural confidence via curriculum innovation, and improving interdisciplinary capabilities of teachers, ultimately transforming education goals from "skill transmission" to "competence cultivation."

1.2 Definition of Core Concepts

Piano Teaching Methods: This refers to systematic theories and practices focused on cultivating piano performance skills, enhancing musical aesthetics, and fostering cultural understanding. It encompasses dimensions such as technical training, repertoire interpretation, and evaluation systems. Traditional methods are characterized by master-apprentice relationships and skill-driven models, while modern innovations emphasize interdisciplinary integration (e.g., music cognition, multiple intelligences), technology empowerment (e.g., AI accompaniment, VR teaching), and cultural deconstruction (e.g., integration of Chinese works and cross-cultural repertoire analysis).

Innovation in Music Education: This involves breaking traditional frameworks in educational philosophy, curriculum design, teaching methods, and assessment systems by introducing new technologies, integrating new resources, and constructing new paradigms to modernize music education. The focus of this study is on innovative paths in piano teaching, including the creation of supportive teaching environments (e.g., immersive classrooms

supported by digital technology), content reconstruction (e.g., localizing Chinese repertoires, developing interdisciplinary courses), and assessment reforms (e.g., flexible evaluation systems, formative assessments).

1.3 Review of Domestic and International Research

Domestic Research: Historically, research on piano teaching methods in China has been centered on the transmission of traditional skills, as exemplified by the Da Zhaoyi teaching system, which has produced many award-winning musicians through systematic finger training and repertoire arrangement. In recent years, there has been a shift toward emphasizing comprehensive ability development, highlighting the importance of musical perception, creativity, and cross-cultural understanding. For instance, Guangzhou University incorporates ideological elements and ethnic music into piano teaching to enhance students' cultural identity. However, domestic research still faces challenges such as insufficient theoretical depth and lagging technological integration, with empirical studies often focusing on descriptive outcomes rather than mechanism analyses grounded in neuroscience and cognitive psychology.

International Research: Piano teaching methods internationally exhibit diversification and technological integration. Classic models such as Orff's approach, Dalcroze eurhythmics, and comprehensive musicianship emphasize playfulness, improvisation, and multi-sensory engagement. Technological innovations, such as intelligent IoT systems, AI practice tools, and VR teaching environments, are gaining attention. Cross-cultural studies also focus on local adaptations of teaching methods, with Japan combining Orff principles with taiko drumming for enhanced musical perception. Nonetheless, international research faces challenges related to cultural fit and the potential for technological innovations to undermine the humanistic qualities of musical expression.

1.4 Research Content and Methods

Research Content: This study utilizes a "technical training-artistic expression-cultural interpretation" framework to systematically analyze the theoretical foundations, practical applications, and innovative paths of piano teaching methods. It includes evaluations of both traditional methods and modern innovations (e.g., comprehensive musicianship, Orff approach, dual piano teaching), presents practical cases in children's education, higher education curricula, and community music education, assesses innovative outcomes, and discusses strategies for innovation in technology, curriculum, and faculty development.

Research Methods:

Bibliometric Analysis: Reviewing research trends and hotspots over the past decade using databases like CNKI and Web of Science.

Comparative Analysis: Comparing classical teaching methods (e.g., Kodály, Orff, and localized practices) to identify innovative elements suitable for contemporary music education.

Theoretical Deduction: Integrating theories from music cognition, multiple intelligences, and constructivist learning to develop a theoretical model for teaching method innovation, verified through case studies.

Empirical Research: Utilizing existing empirical data (e.g., 32% increase in student creativity, 41% improvement in collaborative skills) to support conclusions while analyzing real-world challenges through industry reports (e.g., 63% of teachers lack interdisciplinary training).

2. THEORETICAL FOUNDATIONS AND EVOLUTION OF PIANO TEACHING METHODS

2.1 Analysis of Traditional Teaching Methods (Master-Apprentice and Skill-Driven Models)

Master-Apprentice Model: This traditional method emphasizes one-on-one instruction, focusing on precise technical transmission and individualized training. Its advantages include tailored training plans that address individual differences, especially in advanced technical breakthroughs. For instance, Da Zhaoyi's system has produced numerous international pianists through its structured finger training and classic repertoire analysis, serving as a vital reference for professional institutions. However, limitations exist, including unequal educational opportunities due to resource concentration among a few prominent

teachers, over-reliance on experiential knowledge without scientific backing, and a relatively closed curriculum that fails to meet modern music education's diverse demands.

Skill-Driven Model: This approach prioritizes technical proficiency, simplifying piano learning into quantifiable indicators such as finger independence, speed, and dynamics. It often involves repetitive practice of technical exercises (e.g., Czerny, Hanon) and a utilitarian selection of repertoire that favors difficult, showy pieces. While effective for enhancing performance speed, this model may lead to diminished musical expressiveness. Studies show that students trained primarily under this model score lower on improvisation, emotional expression, and cross-cultural repertoire comprehension. Additionally, it neglects learners' cognitive development patterns, potentially leading to burnout and psychological stress, especially for younger students.

2.2 Innovative Paths in Modern Teaching Methods

Comprehensive Musicianship Approach: This method aims to cultivate holistic musical competence, emphasizing the integration of listening, singing, movement, and performance. Techniques like improvisation, multi-part training, and music analysis aim to enhance creativity and critical thinking. For example, comprehensive musicianship courses in the U.S. guide students through cycles of exploration, imitation, improvisation, and creation. Research indicates that students trained in this method score 32% higher in musical perception and creativity tests compared to traditional models. The theoretical foundations include music cognition (e.g., neural mechanisms of pitch and rhythm) and multiple intelligences theory (emphasizing the synergistic development of musical and other intelligences).

Orff Approach: This method, centered on "elemental music education," encourages students to unlock their musical potential through play, movement, and improvisation. In children's piano instruction, integrating Orff instruments (e.g., xylophones, shakers) with piano lessons significantly enhances rhythm and engagement. Activities like "Note Hide and Seek" and "Dance on the Keyboard" have increased student participation by 85%. The Orff approach also promotes cross-cultural integration, adapting Chinese folk songs like "Jasmine Flower" into rhythm training materials, thereby deepening cultural understanding through kinesthetic movement and improvisational accompaniment. However, its lack of systematic high-level technical training necessitates integration with traditional skill training for comprehensive development.

Dual Piano/Collaborative Teaching: This method involves two or more students working together to enhance cooperation, balance, and musical expressiveness. Dual piano instruction not only requires technical precision but also dynamic coordination through auditory feedback and non-verbal communication. Empirical studies show that students participating in dual piano classes score 41% higher on teamwork assessments compared to solo training. In practice, teachers often implement a "division of labor-documentation-peer evaluation" model to guide students in analyzing relationships between voices and tonal layers. For instance, when performing Debussy's "Children's Games," students must discuss and determine the prominence of melodic lines and the color variations of accompaniment textures. Additionally, dual piano teaching can facilitate interdisciplinary integration, developing multimedia performance courses in conjunction with dance and drama to enhance artistic competence.

3. PRACTICAL APPLICATION OF PIANO TEACHING METHODS IN MUSIC EDUCATION

3.1 Innovation in Children's Piano Education

Orff Rhythm Training to Enhance Engagement: Recognizing children's tendencies toward distraction and limited abstract thinking, the Orff approach employs multisensory participation and gamification to boost motivation. For instance, teachers utilize instruments like xylophones and tambourines for rhythm imitation games, transforming the piano keyboard into a "musical map" that helps students memorize pitch and keys through physical movement. A primary school in Guangzhou reported that classes using Orff rhythm training saw student participation rise

from 52% to 85%, with a 30% faster understanding of musical terminology. Furthermore, the Orff system emphasizes improvisation, encouraging children to create simple melodies based on non-musical elements like stories and paintings, fostering creativity and confidence.

Digital Enlightenment Courses: Leveraging AI practice tools and interactive software (e.g., "Piano Fairy" App) provides personalized learning support for children. These tools address traditional teaching's issues of delayed feedback and sustaining interest through real-time corrections, progress tracking, and achievement systems. For example, an AI practice system utilizing image recognition technology monitors finger positioning on keys, providing immediate correction prompts through animations, leading to a 25% enhancement in technical accuracy for beginners. Additionally, VR technology creates virtual performance environments (e.g., forest concerts, space stages) to enhance immersion and performance desire, particularly beneficial for young children's imaginative development.

3.2 Reform of Professional Courses in Higher Education

Development of Improvisation Accompaniment Courses: Responding to the disconnect between traditional piano education and societal needs, universities are introducing improvisation accompaniment courses to cultivate students' practical musical skills. Course content includes popular harmony arrangement, stylized accompaniment textures (e.g., jazz, Latin), and live improvisation techniques. The Shanghai Conservatory of Music found that through a four-stage teaching approach ("theory-imitation-creation-practice"), students are capable of community performances and music teaching in schools before graduation, resulting in an 18% employment rate increase. Teachers often employ a "task-driven" method, requiring students to create melodies and accompaniments based on given lyrics and optimize their works through peer evaluations.

Simulated Micro-Classroom Practices: To address the "performing without teaching" dilemma in teacher training, simulated micro-classrooms have become crucial. Students design and implement 10-minute teaching segments within a limited timeframe, focusing on setting teaching objectives, overcoming key challenges, and classroom interaction. Research from a Beijing normal university indicated that students trained in simulated micro-classrooms received 15% higher teaching evaluation scores during internships compared to traditional training models. The course also incorporates "peer feedback" and "expert critique" mechanisms, using video playback to analyze teaching behaviors and enhance reflective and improvement capabilities. Additionally, some universities combine micro-classrooms with online education to develop "virtual research rooms," enabling cross-regional sharing of teaching resources.

3.3 Social Music Education Integration

Optimization of Amateur Examination Systems: Traditional examination systems emphasize "speed and accuracy," leading learners to overlook musical expressiveness and cultural understanding. Innovative practices have introduced "music literacy tests" into examination content, including analysis of repertoire backgrounds, improvisation, and cross-cultural piece performances. For instance, the new examination guidelines from the Chinese Musicians Association require candidates to perform a Chinese piece (such as “The Shepherd’s Flute”) and explain its creative background and ethnic music elements. Evaluation methods have shifted from singular performance scoring to comprehensive assessments, incorporating teacher comments and learning process documentation to guide learners' focus on the essence of music learning.

Community Music Education Innovations: Addressing non-traditional learners, such as the elderly and children with special needs, community piano education employs differentiated teaching strategies. For instance, "music therapy courses" designed for seniors promote cognitive function and social skills through simple pieces (like "Jasmine Flower") in both playing and singing; for children with autism, a combination of Orff instruments and piano in "multisensory interventions" utilizes tactile stimulation and rhythm training to improve emotional and communication skills.

A survey conducted in a Shanghai community center revealed a 22% reduction in depressive symptoms among participating seniors, while language expression frequency improved by 19% for autistic children. Furthermore, community education fosters a musical atmosphere through "public performances" and "family music concerts," promoting the socialization of music education.

4. APPLICATION OUTCOMES AND CONTROVERSIES

4.1 Empirical Effects

Enhancement of Student Abilities: Innovative piano teaching methods show significant improvements across various skill indicators. Research indicates that students engaged in comprehensive musical sense training scored 32% higher in musical creativity and 28% in improvisation skills; dual piano teaching enhanced collaborative skills by 41% and team communication efficiency by 25%; digital tools (such as AI practice) increased technical training efficiency by 20%-30%, with real-time error correction speeds achieved. Additionally, cross-cultural repertoire teaching (comparing Chinese works and Western classics) raised students' cultural understanding scores by 18% and critical thinking abilities by 15%.

Optimization of Teaching Effectiveness: Technological innovations significantly improve resource allocation in teaching. VR contextual teaching allows students in remote areas to experience immersive learning similar to urban counterparts, addressing teacher shortages; online course platforms (such as the "Piano Teaching Method" course on China's MOOC) cover over 450 institutions, reaching hundreds of thousands of learners. Course innovations enhance educational adaptability, such as tiered textbook systems (like the four-dimensional modules of the Xindi teaching method) meeting the needs of all age groups, and interdisciplinary courses (like "Piano and Literature," "Piano and Technology") broadening students' knowledge horizons.

4.2 Core Controversies

Efficiency Debate: Traditional Techniques vs. Comprehensive Competence: Some scholars argue that traditional skill training remains foundational in piano learning, and an overemphasis on comprehensive competence may weaken technical foundations. For example, one study found children taught using the Orff method scored 12% lower in tests of basic skills like scales and arpeggios compared to traditional methods. Proponents counter that modern music education has shifted from "training performers" to "cultivating well-rounded talents," arguing that the absence of comprehensive skills limits students' career development and cultural expression. The crux of the debate centers on how to balance "technique" and "art," necessitating empirical research to establish a scientific weighting model.

Teacher Training Bottleneck: 63% of Teachers Lack Interdisciplinary Training: Surveys reveal that 63% of piano teachers in China have not received systematic interdisciplinary training (e.g., music psychology, digital technology applications), hindering the implementation of innovative teaching methods. Some teachers may endorse the Orff philosophy but struggle to implement it effectively due to a lack of experience with instrument usage and improvisational teaching; unfamiliarity with AI practice tools can render technical empowerment superficial. Furthermore, higher education teacher training systems lag, with most piano instructors still focused on performance skills and slow updates to interdisciplinary knowledge. Solutions include establishing micro-certification systems for teachers (e.g., "Orff Teaching Method Certification," "VR Teaching Application Certification") and promoting curriculum reforms in higher education to integrate innovative teaching methods into mandatory courses.

Technological Ethics: Virtual Experience vs. Real Touch: The use of VR and AI technologies raises discussions about the essence of music experience. Supporters argue that virtual environments can transcend spatial and temporal limitations, offering diverse performance settings (e.g., virtual concert halls, historical music reenactments), while AI analysis can accurately diagnose technical issues and enhance learning efficiency. Detractors worry that excessive reliance on virtual feedback may diminish the tactile quality of real key touches and emotional expression, and that standardized technological algorithms might stifle

personalized creativity. For instance, a study indicated that students training extensively with VR exhibited an 8% increase in key pressure control errors on real pianos, alongside a decreased sensitivity to tonal nuances. Balancing technological tools with humanistic experiences will be a key challenge for future innovations.

5. INNOVATIVE PATHWAYS AND CHALLENGE RESPONSES

5.1 Technological Innovation: AI Practice Tools, VR Contextual Teaching

In-depth Development of AI Practice Tools: Integrating computer vision, acoustic analysis, and machine learning technologies to establish intelligent error correction and personalized training systems. For example, utilizing finger motion capture technology to identify incorrect fingerings and generate targeted practice plans in real time; employing big data analysis to pinpoint learners' technical weaknesses and recommend customized training pieces. Additionally, AI can simulate various teaching styles (e.g., classical rigid, popular flexible) to accommodate diverse learning preferences. It is crucial to ensure that AI complements human teachers to avoid the loss of emotional interaction and artistic inspiration.

Expansion of VR Contextual Teaching Scenarios: Beyond virtual concert halls, developing historical and cultural scenes (e.g., Baroque courts, ancient Chinese music ensembles) and cross-cultural experiences (e.g., African drumming, South American tango) to deepen cultural understanding through multimodal stimulation of vision, hearing, and touch. For instance, students wearing VR devices can "travel" to Beethoven's Vienna, observing piano construction and performance habits while experiencing the tactile quality of historical pianos through force-feedback gloves. Challenges include reducing equipment costs, enhancing the realism of scene interactions, and addressing potential dizziness from prolonged use.

5.2 Course Innovation: Incorporating Chinese Works into Curriculum, Interdisciplinary Integration

Systematic Integration of Chinese Works into Curriculum: Organizing classic Chinese piano music (e.g., He Lüting's "The Shepherd's Flute," Wang Jianzhong's "Chasing the Moon") into graded textbooks, accompanied by cultural interpretations and performance guidelines. For instance, the Shanghai Normal University MOOC course on "Piano Teaching Method" emphasizes Chinese works, guiding students to understand ethnic music elements (like pentatonic scales, operatic patterns) as they manifest on the piano through literature reviews, composer interviews, and performance demonstrations. Moreover, encouraging collaboration between teachers and composers to develop original teaching materials, such as adapting the folk song "Jasmine Flower" into a piano piece with improvisational sections, enhances students' local musical creativity.

Development of Interdisciplinary Courses: Breaking down subject barriers by designing "Piano +" course modules. For example:

Piano and Literature: Interpreting poetry (e.g., Li Bai's "Quiet Night Thoughts") and novels (e.g., musical scenes in "Dream of the Red Chamber") to guide students in expressing literary sentiments through piano tones.

Piano and Technology: Exploring the integration of electronic music, sequencer programming, and piano performance to cultivate digital music creation skills.

Piano and Psychology: Investigating the impact of music on emotional regulation and cognitive development, leading to the development of music therapy courses.

These courses should involve interdisciplinary teaching teams and promote knowledge integration through project-based learning (e.g., creating multimedia music narrative works).

5.3 Teacher Training: Micro-Certification Systems, Mandatory Teaching Method Courses

Establishment of Micro-Certification Systems: Developing modular certification courses for innovative teaching methods (e.g., Orff, dual piano, VR teaching) that allow teachers to obtain certifications through online learning and practical assessments. For instance, the "Orff Teaching Method Micro-Certification" includes theoretical study (30 hours), practical application (designing and implementing 10 lessons), and effectiveness evaluation (student feedback and expert critiques), granting

certified teachers priority in international exchange projects. This system should be linked to professional title evaluations and performance rewards to incentivize continuous learning among teachers.

Reform of Teaching Method Courses in Higher Education: Strengthening teaching method courses within music education programs, expanding traditional "piano performance" courses into "Piano Teaching Method and Practice" that covers teaching design, classroom management, technical training, and innovative methods. For instance, the China Conservatory of Music has added a mandatory course on "Digital Music Teaching Technology," teaching the development and application of AI tools and VR resources; Sichuan Conservatory of Music has introduced a "Localized Teaching Method," researching the integration of Gordon's Music Learning Theory with local educational needs. Additionally, inviting frontline teachers and technical experts to participate in teaching through workshops and case studies enhances students' practical capacities.

6. CONCLUSION

This study, through systematic theoretical construction and empirical analysis, reveals the effectiveness and innovative pathways of piano teaching methods in music education. While traditional teaching methods maintain irreplaceable advantages in skill training, modernization requires interdisciplinary integration and technological empowerment. The three major innovative pathways of modern teaching methods (digital technology empowerment, cultural deconstruction and interpretation, flexible evaluation systems) provide a practical framework for constructing teaching paradigms that meet contemporary demands. Empirical data indicates that innovative teaching methods significantly enhance learners' musical perception, multimodal expression abilities, and cultural interpretation skills.

However, innovative practices still face challenges such as efficiency debates, teacher training bottlenecks, and technological ethics. Future research should delve deeper by exploring the mechanisms through which innovative teaching methods affect brain plasticity via neuroscience experiments; establishing cross-cultural teaching effectiveness evaluation models to optimize localization strategies; and promoting policy support and industry collaboration to facilitate the democratization of technological tools and educational resources. This research not only offers a new perspective for refining the piano teaching theoretical framework but also provides practical guidance for the professionalization and internationalization of music education, significantly contributing to the cultivation of musically talented individuals with both technical proficiency and cultural depth.

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Research on the Application of Internet Technology and Network Security Management

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Abstract: With the rapid development and widespread application of internet technology, network security management faces new opportunities and challenges. Studying the relationship and collaborative development between the two is of significant importance. This paper employs literature review and theoretical analysis to systematically outline the new forms of internet technology applications and their impacts on network security management, while deeply analyzing the development paths of network security management amid rapid technological iterations. The study categorizes internet technology application scenarios, explores the characteristics of emerging technologies such as big data, artificial intelligence, and the Internet of Things, and analyzes the security threats and management difficulties encountered in the application of these technologies within the theoretical framework of network security management. The findings indicate that the deepening of internet technology applications drives innovations in network security management technologies and upgrades management models, while effective network security management provides a safeguard for the stable application of internet technology, necessitating collaborative development. The study proposes the establishment of a dynamic and intelligent network security management system to adapt to the evolving demands of internet technology, providing secure support for its healthy development.

Keywords: Internet technology; technology application; network security management; collaborative development; security system

1. INTRODUCTION

1.1 Research Background and Significance

In today's digital age, internet technology continues to evolve and expand at an astonishing pace. From early simple information sharing to its deep integration into various socio-economic aspects, its influence permeates all facets of life, work, and social operations. By the end of 2023, global internet users surpassed 5 billion, with an internet penetration rate of approximately 63%. In China, the rapid growth of internet users has positioned it as a key force in driving economic growth, social progress, and improved quality of life.

The e-commerce sector has experienced explosive growth, exemplified by domestic platforms during the 2023 "Double Eleven" shopping festival, achieving record transaction volumes in the hundreds of billions. This success is backed by convenient shopping experiences, efficient logistics, and targeted marketing enabled by internet technology. Internet finance has surged, transforming traditional payment methods with mobile payments. In 2023, China's mobile payment transaction volume reached trillions, significantly enhancing payment efficiency and reducing transaction costs. Remote work and online education have also flourished, particularly during critical periods, with over 70% of enterprises adopting remote work and many schools swiftly transitioning to online education to maintain continuity.

However, the expansion of internet technology applications has introduced severe network security issues. Cyberattacks are rising rapidly in complexity and frequency, with ransomware attacks causing substantial losses; global economic damage from such attacks reached billions in 2023. Hacker methods are evolving, threatening critical infrastructure and national economic security. Data breaches have become commonplace,

infringing on personal privacy, exemplified by a major social platform's massive data leak affecting hundreds of millions of users, sparking widespread concern and trust crises.

Against this backdrop, researching the interplay between internet technology applications and network security management is critical. It aids in leveraging internet advantages for digital transformation and innovation across industries while safeguarding national sovereignty and security interests. Strengthening network security management effectively counters external threats, protects critical infrastructure, and fosters public trust in the internet, contributing to a healthy, secure, and orderly online environment.

1.2 Literature Review

Research on the application of internet technology and network security management began earlier abroad, yielding rich. Developed countries, particularly in Europe and North America, are leading in the development and application of emerging technologies, with significant investments in artificial intelligence and big data enhancing their applications across finance, healthcare, and transportation. For instance, U.S. financial institutions utilize big data for precision marketing and risk assessment, while the EU has established strategies and standards for IoT development.

Domestically, significant strides have been made in recent years, with China at the forefront in areas like 5G, e-commerce, and mobile payments. The rapid adoption of 5G supports advancements in smart manufacturing and transportation. Research in network security management has progressed, focusing on threat detection and proactive defense. The government has enacted robust legislation, establishing a comprehensive legal framework for network security. Despite these advancements, research gaps remain, particularly in developing a systematic, comprehensive theoretical framework for the synergistic growth of internet applications and security management.

2. OVERVIEW OF INTERNET TECHNOLOGY APPLICATIONS

2.1 Major Fields of Internet Technology Application

2.1.1 E-commerce

E-commerce has established a vast ecosystem for online transactions, allowing consumers to easily browse and purchase products globally via various platforms. For instance, leading domestic platforms like Taobao and JD.com aggregate numerous brands, offering a wide range of products. Consumers benefit from advanced search and filtering capabilities for efficient decision-making. Additionally, secure payment systems support multiple payment methods, ensuring transactional safety, while logistics partnerships facilitate real-time order tracking. As of 2023, China's e-commerce transaction volume reached 42.3 trillion yuan, reflecting the powerful impact of internet technology in this field.

2.1.2 Internet Finance

Internet finance represents a deep integration of technology with traditional finance, widely transforming payment habits. Mobile payment tools like Alipay and WeChat Pay are ubiquitous, enhancing convenience and efficiency. In 2023, China's mobile payment transactions reached 139.175 billion, with a total volume of 470.81 trillion yuan, indicating significant growth. Online lending platforms have also emerged, providing new financing options for individuals and small businesses through rapid assessments and streamlined processes.

2.1.3 Remote Work and Online Education

Remote work and online education have transcended time and spatial limitations through the support of internet technology. Employees can connect to corporate systems remotely, utilizing tools for file sharing and video conferencing. During the pandemic, platforms like Tencent Meeting became essential for maintaining business operations. As of 2023, over 50% of companies reported adopting long-term remote work models. The online education sector has similarly thrived, with platforms offering diverse resources across all educational levels, accommodating various learning styles and demands.

2.2 Characteristics of Emerging Internet Technology Applications

2.2.1 Big Data

Big data applications in the internet realm are characterized by vast data volumes, diverse types, rapid processing speeds, and low information density. The exponential growth

of data generation encompasses various formats, necessitating advanced processing and analytics capabilities. Companies leverage big data to enhance decision-making and optimize customer engagement through real-time behavior analysis.

2.2.2 Artificial Intelligence

Artificial intelligence demonstrates remarkable adaptability and learning capacity in internet applications. Intelligent customer service systems utilize natural language processing to provide 24/7 support, significantly enhancing efficiency and reducing costs. AI technologies also empower image recognition in social media and security domains, ensuring public safety through real-time monitoring and behavior analysis.

2.2.3 Internet of Things (IoT)

IoT technology facilitates connectivity between devices and individuals, with applications ranging from smart homes to industrial automation. In smart homes, users can control devices remotely via mobile apps, enhancing convenience. In manufacturing, IoT enables real-time monitoring and predictive maintenance, improving operational efficiency. In transportation, IoT enhances traffic management and safety through real-time data exchange among vehicles.

3. THEORETICAL FOUNDATIONS OF CYBERSECURITY MANAGEMENT

3.1 Concept and Objectives of Cybersecurity Management

Cybersecurity management involves employing a set of strategies, processes, and technologies to protect various resources within a network environment, ensuring the confidentiality, integrity, and availability of network systems. Confidentiality necessitates that information within the network is accessed and utilized only by authorized individuals, preventing data leakage. For financial institutions, sensitive data, such as customer account information and transaction records, must be rigorously safeguarded against unauthorized access and misuse. Integrity ensures that data remains unaltered during transmission, storage, and processing, maintaining its authenticity and accuracy; for instance, in e-commerce, the integrity of order information is crucial to prevent disputes and financial loss. Availability guarantees that network systems and services operate normally at all times, meeting user needs. High availability is essential for online gaming platforms and e-commerce websites to attract users and sustain business operations.

The objectives of cybersecurity management are multi-dimensional. From an asset protection standpoint, it aims to safeguard hardware, software, and data against various security threats. Key assets like servers, network switches, operating systems, and applications require effective security management to prevent damage, theft, or malicious attacks. For critical data, securing its storage and transmission is vital to prevent loss, leakage, and tampering. In maintaining business continuity, cybersecurity management ensures stable operations by preventing and responding to security incidents. When faced with cyberattacks or natural disasters, well-defined emergency plans enable rapid recovery of network systems and services, minimizing economic losses and reputational damage. Additionally, cybersecurity management seeks to meet compliance requirements, ensuring that network operations adhere to national laws, industry standards, and internal security policies. With the continuous enhancement of cybersecurity regulations, organizations must comply strictly to mitigate legal risks and penalties.

3.2 Fundamental Principles and Methods of Cybersecurity Management

Cybersecurity management follows several key principles. The principle of least privilege dictates that users and processes are granted the minimum necessary permissions to perform their tasks. Within organizations, employees should only access relevant files and applications, thus reducing security risks associated with privilege misuse. The principle of defense in depth emphasizes the implementation of multi-layered and varied security measures, creating a robust security architecture. For example, firewalls can block unauthorized external access, while intrusion detection systems monitor for attacks in real-time, and critical data is encrypted to enhance overall system security. The principle of dynamism acknowledges the ever-evolving nature of the cybersecurity landscape;

management strategies must adapt to emerging threats. Systems should be capable of timely identification and response to new attack techniques, with regular security assessments and vulnerability scans to address newly discovered vulnerabilities.

Cybersecurity management employs diverse methods. Access control is a crucial technique that uses identity verification and authorization to restrict access to network resources. Common authentication methods include username/password, fingerprint recognition, and facial recognition, allowing users to access specific resources based on their identity and role. Vulnerability management involves regular system scans to detect and address security vulnerabilities, with tools identifying flaws in operating systems, applications, and network devices. Organizations can then apply security patches to mitigate the risk of exploitation. Security auditing entails tracking and analyzing network activities to identify potential security issues, providing valuable insights for subsequent investigations. Finally, incident response methods involve executing predefined emergency plans when security incidents occur, ensuring a swift response to minimize damage.

4. IMPACT OF INTERNET TECHNOLOGY APPLICATIONS ON CYBERSECURITY MANAGEMENT

4.1 Security Opportunities from Technological Applications

Continuous innovation in internet technology provides revolutionary tools and strategic frameworks for cybersecurity management. Big data technologies facilitate the construction of multi-dimensional risk assessment models through the deep analysis of massive network traffic, user behavior, and threat intelligence. For instance, a financial institution leveraging big data analytics achieved real-time anomaly detection in transactions, reducing fraud losses by 67%. Artificial intelligence techniques shift intrusion detection from rule-based passive defense to behavior-based proactive defense. Deep learning models can identify zero-day exploits that traditional methods often miss; tests in controlled environments have shown AI models achieving a 92.7% detection accuracy for these vulnerabilities, a 40 percentage point improvement over traditional solutions. Furthermore, the proliferation of IoT devices has spurred innovations in edge computing and endpoint security, with lightweight AI models deployed directly on smart devices for localized threat detection and rapid response.

In terms of management model innovation, cloud computing and virtualization technologies have evolved cybersecurity protection from isolated defenses to a collaborative cloud-network defense system. The Ningxia hub's cloud security operations management platform integrates comprehensive security capabilities, achieving centralized control over multi-cloud environments and successfully blocking 341 network intrusions and 84,758 malicious scans. Additionally, the decentralized and immutable characteristics of blockchain technology provide new paradigms for data integrity verification and trust mechanisms; for example, in supply chain scenarios, blockchain ensures trustworthy traceability of software code throughout its lifecycle, effectively mitigating supply chain attacks like the SolarWinds incident.

4.2 Security Challenges from Technological Applications

The deepening of technological applications has also led to increasingly complex and diverse cybersecurity threats. The large-scale integration of IoT devices has vastly expanded the attack surface, with low-power, poorly authenticated endpoints emerging as weak links for hackers. According to a report by Picus Security, 40% of enterprise networks contain vulnerabilities that allow attackers to gain domain administrator privileges, potentially enabling automatic lateral movement throughout the network. The 2021 Kaseya VSA supply chain attack exemplified this, where ransomware infiltrated the systems of a managed service provider, affecting over 1,500 companies worldwide and resulting in billions in economic losses.

The widespread adoption of cloud computing and virtualization technologies has introduced new security risks. Traditional perimeter defenses often fail in cloud environments, leading to frequent incidents of virtual machine escape and cloud storage data

breaches. In a 2023 data leak incident involving a multinational corporation, attackers bypassed VPN protections by hijacking dynamic public IP addresses, directly penetrating core business systems and revealing vulnerabilities in identity verification and access control mechanisms in cloud settings. Additionally, the extensive use of containerization technology exacerbates attack surface fragmentation, as malicious code in container images can spread through CI/CD pipelines to entire development and testing environments.

The misuse of artificial intelligence and machine learning technologies has also given rise to novel attack methods. Generative AI can produce realistic phishing emails and fraudulent traffic, while adversarial sample attacks manipulate input data to evade detection by traditional models. Experiments indicate that deep learning models trained against such adversarial attacks achieved only 89% accuracy in identifying GAN-generated malicious traffic, highlighting significant misjudgment risks. Moreover, data-driven business models have turned personal and sensitive information into prime targets for hackers; for instance, in a 2023 incident involving a university database leak, over 30 million records of faculty and student information were illegally accessed, underscoring the critical importance of managing data throughout its lifecycle.

5. THE ROLE OF CYBERSECURITY MANAGEMENT IN INTERNET TECHNOLOGY APPLICATIONS

5.1 Protective Role of Security Management in Technological Applications

Cybersecurity management builds a systematic protection framework that underpins the stable application of internet technologies. Access control mechanisms, grounded in the principle of least privilege (POLP), manage user and device permissions with precision; when combined with multi-factor authentication (MFA) and device health checks, these measures effectively prevent unauthorized access and privilege misuse. For example, Beijing's advanced autonomous driving demonstration zone achieved safe connectivity for 838 networked vehicles and 367 intelligent intersections through hierarchical data governance across vehicle, road, and cloud endpoints, ensuring the continuity of autonomous driving services.

The enhancement of emergency response mechanisms ensures the resilience of technological applications. The national cybersecurity emergency system has developed emergency plans and conducted realistic drills to improve handling capabilities for significant security incidents. During the 2023 Russia-Ukraine conflict, key infrastructure operators in China implemented measures like traffic cleaning and threat intelligence sharing, successfully fending off multiple distributed denial-of-service (DDoS) attacks. Additionally, security auditing and compliance management compel organizations to fulfill data security responsibilities; for instance, a water conservancy bureau implemented a domestically produced firewall and situational awareness platform, achieving comprehensive lifecycle protection of its water management systems and addressing over 30,000 malicious code incidents.

5.2 Promotional Role of Security Management in Technological Innovation

Cybersecurity management fosters a controlled-risk innovation environment that accelerates the advancement of technological applications. Dynamic risk assessment mechanisms encourage organizations to explore new technological applications within secure boundaries; for example, zero trust architecture (ZTA) promotes secure access in hybrid work and multi-cloud environments with its "never trust, always verify" approach. A retailer deploying ZTA reported a 70% reduction in data breach incidents. Furthermore, regulatory compliance requirements drive technological innovation; the implementation of the EU's General Data Protection Regulation (GDPR) has prompted companies to develop data anonymization technologies like differential privacy and federated learning, balancing privacy protection with data value extraction.

A robust cybersecurity industry ecosystem supports technological innovation. In China, the cybersecurity industry has been growing at an annual rate exceeding 20%, with the market size surpassing 200 billion yuan in 2023. Collaborative industry-academic-research

mechanisms have facilitated breakthroughs in critical technologies, such as the regulatory sandbox for large model training developed by the Beijing Academy of Artificial Intelligence in conjunction with industry partners, ensuring the security of AI research through a comprehensive framework of computing, data, and compliance. Moreover, the establishment of standard frameworks has standardized security requirements for technological applications; for instance, the National Data Bureau's guidelines for the integrated national computing network security operations management provide technical guidance for initiatives like "Eastern Data to Western Computing."

6. STRATEGIES FOR COLLABORATIVE DEVELOPMENT OF INTERNET TECHNOLOGY APPLICATIONS AND CYBERSECURITY MANAGEMENT

6.1 Establishing a Dynamic Cybersecurity Management System

The core of a dynamic management system is the establishment of an adaptive risk response mechanism. By integrating threat intelligence, traffic monitoring, and user behavior analytics, risk assessment models can be updated in real-time. For example, an intelligent IP profiling system correlates over 20 global threat intelligence sources and local network behavior data, generating risk scores and behavioral baselines for IP addresses. It automatically triggers multi-level verifications when detecting anomalies, such as a geographic jump of 500 km/hour. At the network architecture level, micro-segmentation divides enterprise networks into over 30 finely-grained security zones, restricting lateral spread of malware; after implementation, a financial institution reported an 85% decrease in internal network incidents.

Zero trust architecture (ZTA) exemplifies dynamic management practices. Its implementation involves four stages: asset identification, risk assessment, policy formulation, and technology deployment. In identity verification, strong authentication is achieved through biometrics, device fingerprints, and digital certificates; at the access control level, software-defined boundaries (SDP) conceal network resources, allowing only authorized users to access through encrypted tunnels. Continuous monitoring and dynamic policy adjustments are critical components of ZTA; for instance, a telecom operator utilized user behavior analysis (UEBA) systems to identify violations by internal employees in real-time, mitigating data leak risks.

6.2 Promoting the Development and Application of Intelligent Security Technologies

The development trajectory of intelligent security technologies centers on proactive defense and cognitive intelligence. Behavior analysis engines powered by deep learning can create multi-dimensional threat feature maps, identifying attack patterns that traditional methods may overlook. For instance, the AI defense system of Tianyi Cloud successfully detected malware variants over three generations through analysis of process call chains, memory operation patterns, and network traffic timing features. Predictive defense technologies employ spatiotemporal graph convolution networks (ATGCN) to simulate attack paths, deploying bait systems at critical nodes to increase the likelihood of detecting attackers before they achieve their objectives by 73%.

Cognitive intelligence is reshaping security operations models. Threat-hunting systems powered by large language models can automatically correlate multi-source heterogeneous data; when analysts input natural language descriptions like "anomalous domain controller authentication requests," the system retrieves logs and generates investigation guidelines, quadrupling the efficiency of advanced threat hunting. Additionally, generative AI is being utilized in attack-defense drills, where high-fidelity attack scenarios generated by diffusion models help security teams enhance the generalizability of their defense systems; after three rounds of iterative training, a tech company reduced its new attack response time by 68%. Furthermore, the development of post-quantum cryptography (PQC) algorithms provides forward-looking security assurances, with a fusion strategy of the national secret SM9 algorithm and quantum random number

generation technology capable of resisting hardware-level threats like cold start attacks.

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Research on the Application and Evaluation of Internet New Media Technology in Business English Teaching

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Abstract: With the rapid development of Internet new media technology, its application value in business English teaching has become increasingly prominent. This study aims to explore the application mode and effect evaluation system of Internet new media technology in business English teaching. Through the literature research method to sort out the relevant research results at home and abroad, combined with the research methods combining quantitative and qualitative approaches such as questionnaire surveys and classroom observations, the application process of Internet new media technology in business English teaching is deeply analyzed from the dimensions of teaching resource integration, teaching mode innovation, and learning effect improvement. Research has found that Internet new media technology can effectively enrich teaching resources, innovate interaction models, and significantly enhance students' learning interest and language application ability. However, there is still room for improvement in terms of the depth of technology application and the effect of interaction between teachers and students. Based on this, a three-dimensional evaluation system including the adaptability of technology application, the effectiveness of the teaching process, and the achievement degree of learning outcomes was constructed, providing a theoretical basis and practical reference for optimizing the application of Internet new media technology in business English teaching.

Key words: Internet, New Media Technology Business English teaching Teaching application Effect evaluation Evaluation system

1. PREFACE

1.1 Research Background and Significance

In the era background of the deep integration of globalization and digitalization, international business activities are flourishing with an unprecedented level of activity. According to relevant statistics, the compound annual growth rate of global cross-border e-commerce transaction volume has exceeded 15% in the past five years. A large number of enterprises have engaged in international market competition and are eager to attract compound talents with solid business knowledge and fluent English application skills. Business English, as a key tool for international business communication, its teaching quality is directly related to the cultivation effect of such talents. Under the new economic situation, there is an urgent need for comprehensive innovation from teaching concepts to teaching methods.

Internet new media technologies, having undergone continuous iterations, are profoundly reshaping social life and the educational ecosystem. New media forms represented by short videos, live streaming online and interactive learning platforms have rapidly permeated every corner of the education field with their significant advantages such as immediacy, interactivity and personalization. The market size of online education is experiencing explosive growth. According to authoritative institution reports, the global online education market size will exceed 370 billion US dollars in 2024, among which language learning online courses are particularly favored. Under this wave, business English teaching has ushered in a strategic opportunity period of digital transformation. With the help of Internet and new media technologies, it is expected to break through the limitations of traditional teaching models, achieve diversified integration of teaching resources, innovative

optimization of teaching models, and personalized upgrading of learning experiences, and create a learning environment that is more in line with the needs of The Times and more effective for students.

This research is dedicated to deeply analyzing the application mechanism and practical effect of Internet new media technology in business English teaching, aiming to provide practical theoretical basis and practical guidance for the improvement of teaching quality in this field. On the one hand, by systematically sorting out the application status of Internet new media technology in aspects such as the integration of business English teaching resources, the innovation of teaching models, and the construction of personalized learning paths, the advantages and potential problems in its application process are revealed, providing targeted improvement directions for teaching practice; On the other hand, it is necessary to build a scientific, comprehensive and operational effect evaluation system, precisely quantify the impact of technology application on teaching effectiveness, assist educators and educational administrators in making scientific decisions based on data, promote the high-quality and sustainable development of business English teaching in the digital age, and cultivate more outstanding talents who can shine on the international business stage.

1.2 Review of Research Status at Home and Abroad

Foreign countries started earlier in the field of the integration of Internet new media technology and language teaching, and have accumulated rich research results. In terms of business English teaching, many scholars focus on the transformation of teaching models brought about by new media technologies. For instance, Smith et al. (2022) found through empirical research that by using online interactive platforms to conduct case discussions on business English, students' participation increased by 30%, and their language expression and problem-solving abilities were significantly enhanced. Jones' (2023) research indicates that business negotiation simulation scenarios created based on virtual reality (VR) technology can effectively enhance students' cross-cultural communication skills and business communication techniques. In the construction of the evaluation system, foreign scholars mostly adopt multivariate statistical analysis methods, combined with the data of the Learning Management System (LMS), to conduct a comprehensive assessment of students' learning processes and achievements, emphasizing the comprehensiveness and dynamics of evaluation indicators.

Domestic related research has shown a rapid growth trend in recent years. In terms of applied research, scholars generally focus on how new media technologies can optimize the allocation of teaching resources and enrich teaching methods. Wang Fang (2021) proposed that integrating domestic and international business information, cases and other resources through new media platforms can broaden students' horizons and enhance their knowledge reserves. Zhang Yu (2022) explored the application of live-streaming teaching in business English listening and speaking courses, believing that it can interact in real time and create an immersive language environment. In the research of the evaluation system, domestic studies focus on combining the characteristics and demands of local education to construct an evaluation model covering multiple dimensions such as the teaching process and student development. However, there is still room for improvement in the refinement of evaluation indicators and the innovation of evaluation tools.

Based on domestic and foreign research, although certain progress has been made in the application of technology and the construction of the evaluation system, there are still deficiencies. On the one hand, systematic research on the application of Internet new media technology in business English teaching is still weak, and there is a lack of in-depth exploration of the collaborative application of different technical means. On the other hand, the universality and effectiveness of the evaluation system in actual teaching scenarios need to be further verified, and less attention is paid to the role and function of teachers in the process of technology application. Based on the existing research, this study will make up for the above deficiencies and deeply explore the application potential and optimization path of Internet new media technology in business English teaching.

2. OVERVIEW OF INTERNET NEW MEDIA TECHNOLOGY AND BUSINESS ENGLISH TEACHING

2.1 The Connotation and Characteristics of Internet New Media Technology

Internet new media technology is a collection of emerging technologies that rely on the Internet platform and integrate computer technology, communication technology, etc., to achieve digital information dissemination and interaction. Its connotation covers various forms, such as social media platforms, online video streaming media, mobile learning applications, and virtual reality/augmented reality (VR/AR) technologies, etc. These technologies have broken the limitations of traditional media in terms of time and space, and reshaped the mode of information dissemination and reception.

From the perspective of characteristics, Internet new media technologies have remarkable immediality. Information can spread globally at a speed of seconds, enabling learners to obtain the latest business information and industry trends in real time. Interactivity is another core feature of it. Users are no longer passive information receivers. They can participate in content creation and dissemination through comments, likes, shares, etc., forming a two-way or even multi-directional information interaction model. Take the Business English learning community as an example. Students can post learning questions at any time, share learning experiences, and communicate with teachers and classmates in real time, which greatly enhances their sense of participation and initiative in learning.

Personalized customization is also a prominent advantage of Internet new media technology. By leveraging big data analysis and artificial intelligence algorithms, the system can accurately understand learners' interest preferences, learning habits, and knowledge mastery levels, and tailor learning resources and course contents that meet their individual needs. For instance, online English learning apps can intelligently adjust subsequent learning plans based on students' answering situations and learning trajectories, provide targeted intensive training, and achieve precise guidance in the learning process.

In addition, Internet new media technologies have strong resource integration capabilities, capable of fusing various media forms such as text, images, audio, and video to create rich and diverse learning scenarios. In business English teaching, resources such as business negotiation videos, product introduction audios, and contract texts can be organically integrated to present students with real and three-dimensional business scenarios, enhance the intuitiveness and attractiveness of the learning content, and help students better understand and apply knowledge.

2.2 Characteristics and Requirements of Business English Teaching

Business English, as an interdisciplinary subject integrating English language knowledge with business professional knowledge, has distinct characteristics and unique teaching requirements. At the language level, Business English is professional and standardized, involving a large number of professional vocabularies, terms and specific sentence structures. For example, in the field of international trade, professional terms such as "Letter of Credit" and "Bill of Lading" are frequently used, and business contracts, correspondence and other texts follow strict format and language norms, requiring students not only to master the meaning of the words, It is even more important to be able to apply it accurately and standardly in actual business communication.

From the perspective of business knowledge, business English teaching covers knowledge in multiple fields such as international trade, marketing, business management, finance and accounting, etc. The knowledge system is complex and highly practical. Students need to understand the business processes, operational norms and cultural differences in different business scenarios. For example, in international business negotiations, they not only need to communicate fluently in English, but also be familiar with negotiation strategies, etiquette customs and other knowledge, so as to effectively deal with complex business situations.

In terms of teaching requirements, given the practical-oriented nature of Business English, students expect to acquire the ability to

communicate effectively and solve problems in English in actual business environments through learning. This requires that the teaching process be closely aligned with real business scenarios, provide sufficient practical opportunities, and cultivate students' language application ability and business practice skills. Meanwhile, with the rapid development and changes of international business activities, teaching content needs to be updated in a timely manner to reflect the latest dynamics and trends in the industry and ensure the timeliness and applicability of the knowledge and skills that students learn. The traditional single classroom teaching mode is difficult to meet the above demands. It is urgent to rely on Internet and new media technologies to innovate teaching means and methods, optimize the allocation of teaching resources, inject new vitality into business English teaching, and improve the teaching quality and the effect of talent cultivation.

3. ANALYSIS OF THE APPLICATION OF INTERNET NEW MEDIA TECHNOLOGY IN BUSINESS ENGLISH TEACHING

3.1 Digital integration and expansion of teaching resources

The new media technology of the Internet has opened up broad space for the digital integration and expansion of business English teaching resources. In terms of resource acquisition channels, various online databases and academic platforms have become important channels for teachers and students to obtain professional literature and research reports. Academic databases such as China National Knowledge Infrastructure (CNKI) and Web of Science contain a vast amount of literature related to business English, covering multiple fields such as industry research and discussions on teaching methods. Teachers and students can search and download as needed to keep abreast of the latest developments in the discipline in a timely manner. Meanwhile, many internationally renowned business information platforms, such as Bloomberg and Financial Times, provide first-hand materials like real-time financial news and market analysis, offering rich and authentic language materials for business English teaching.

In terms of resource integration methods, teachers can make use of online course production tools, learning management systems (LMS), etc., to organically integrate scattered resources such as text, audio, and video, and build a structured and systematic teaching resource library. Take the Business English writing course as an example. Teachers can collect resources such as templates of different types of business documents, excellent examples, and writing guidance videos, and upload them to the school's online learning platform. Students can access and study at any time according to their learning progress and needs. In addition, by leveraging the hyperlinks and multimedia embedding functions of new media platforms, interactive learning resources can be created. For instance, when explaining the terms of business contracts, by linking to videos interpreting relevant legal provisions and analyzing actual cases, students can gain a deeper understanding of the contract content and application scenarios.

From the perspective of the effect of resource expansion, the richness and convenience of digital resources have greatly broadened students' learning horizons. According to the survey, after using digital teaching resources, the average extracurricular reading volume of students has increased by 40%, and their attention to hot topics in the business field has significantly improved. Meanwhile, the dynamic update feature of resources ensures that teaching content keeps pace with the development of the industry. For instance, after the rise of cross-border e-commerce, teachers can quickly integrate relevant teaching resources, incorporate this emerging business model into teaching content, keep students' knowledge in step with market demands, and enhance the timeliness and practicality of teaching. Lay a solid knowledge foundation for students to apply English in future business practices.

3.2 Innovation in Interactive Teaching Mode

The Internet new media technology has deeply empowered the innovation of the interactive teaching mode of business English, bringing profound changes from the form of classroom interaction to the teaching feedback mechanism. In terms of classroom interaction,

live-streaming teaching has become an important means. Teachers can conduct real-time teaching through online live streaming platforms such as Tencent Classroom and DingTalk Live, breaking the time and space limitations of traditional classrooms and achieving remote teaching. During the live broadcast, by leveraging the platform's interactive features such as voice calls, bullet comments, and voting, students' enthusiasm for participation can be effectively stimulated. For instance, in a business English oral class, teachers can organize online group discussions. Students can share their viewpoints through live connections, while other students express their opinions in the form of bullet comments, creating an active classroom atmosphere and enhancing students' oral expression and communication skills.

Online learning communities are also important platforms for promoting interaction. All kinds of English learning apps and professional forums have built Bridges for communication and interaction between students and teachers as well as among students themselves. In the Business English learning community, students can post learning questions and share learning experiences at any time, and teachers can provide timely guidance and feedback. When students encounter difficulties in translating business contracts, they can post for help in the community. Teachers and other students will provide answers from the perspectives of professional knowledge and translation skills, creating a mutually supportive learning atmosphere. This kind of cross-temporal and spatial interaction and communication makes learning no longer confined to the classroom and expands the dimensions of learning time and space.

In terms of the innovation of the teaching feedback mechanism, new media technology provides diversified means of data collection and analysis. The learning management system can automatically record students' learning trajectories, including the number of course visits, the completion of homework, test scores and other data. By analyzing these data, teachers can accurately understand students' learning progress and weak links in knowledge acquisition, and adjust teaching strategies in a timely manner. For instance, if the system indicates that the error rate of students' homework for a certain chapter's knowledge points is relatively high, teachers can enhance their explanations or organize specialized exercises in subsequent classes in a targeted manner to achieve precise control of the teaching process, improve teaching effectiveness, and promote students' personalized learning and development.

3.3 Construction of Personalized Learning Paths

Internet new media technologies, with advanced technologies such as big data analysis and artificial intelligence, provide strong support for the construction of personalized learning paths in business English teaching. In the learning needs analysis stage, by leveraging students' behavioral data on the learning platform, such as study time, course selection, and answering situations, and using big data algorithms for in-depth mining and analysis, it is possible to accurately understand students' learning styles, interest preferences, and knowledge mastery levels. For example, if students frequently visit business English courses related to marketing and perform well in relevant tests, the system can determine that they have a strong interest in this field and a good grasp of it, providing a basis for subsequent personalized learning planning.

Based on the analysis results of learning needs, precise push of learning content can be achieved. Online learning platforms, with the aid of artificial intelligence technology, screen and push learning content that meets the needs of individual students from a vast teaching resource library based on their individual profiles. For students who are good at business negotiations but need to improve their writing skills, the platform gives priority to pushing resources such as business English writing courses and model cases to help them study and train in a targeted manner. Meanwhile, by using adaptive learning technology, the learning difficulty can be dynamically adjusted. When students perform well during the learning process, the system automatically increases the difficulty of the subsequent learning content. If difficulties are encountered, the system will reduce the difficulty or provide additional tutoring

resources to ensure that the learning process is both challenging and within the students' affordability.

In terms of learning progress management, students can independently formulate their study plans on the learning platform based on their own learning abilities and time arrangements. The platform provides a visual progress tracking function

4. CONSTRUCTING AN EVALUATION SYSTEM FOR INTERNET NEW MEDIA TECHNOLOGY IN BUSINESS ENGLISH TEACHING

4.1 Principles for Selecting Evaluation Indicators

The first step in constructing a scientifically sound evaluation system for Internet new media technology in Business English teaching is to clarify the principles for selecting evaluation indicators.

Comprehensiveness Principle: Evaluation indicators should cover all key aspects of technology application and various dimensions of teaching effectiveness. From a technical perspective, it is essential to assess the rationality, stability, and usability of the chosen tools. In the teaching process, indicators such as efficiency of resource utilization, level of interactive engagement, and student participation should be evaluated. Regarding learning outcomes, attention must be given to students' mastery of knowledge, improvement in language application skills, and development of business practice competencies. For instance, when assessing resource utilization efficiency, one should not only examine the frequency of resource use but also analyze its actual contribution to students' understanding and problem-solving abilities.

Objectivity Principle: Indicators should be based on objective data to minimize subjective biases. Data collected through learning management systems and online teaching platforms—such as student online learning duration, homework accuracy, and exam scores—can provide reliable support for evaluations. For difficult-to-quantify indicators like student attitudes and innovative thinking, detailed evaluation scales should be established, incorporating teacher observations and peer evaluations to ensure objectivity. For example, student attitudes can be evaluated through quantifiable standards reflecting participation, homework completion diligence, and initiative, with scores assigned by both teachers and peers.

Targeted Principle: Indicators should closely align with the characteristics and objectives of using Internet new media technology in Business English teaching. Unlike traditional evaluation methods, emphasis should be placed on assessing the effectiveness of technology applications, such as the role of new media platforms in facilitating teaching interactions and enhancing personalized learning paths. Additionally, it is crucial to focus on students' English application skills in business contexts, including negotiation and report writing. For instance, specific indicators can be set to evaluate students' language use, communication strategies, and problem-solving abilities in virtual business negotiation scenarios.

Dynamic Principle: Given the rapid development of Internet new media technologies and the dynamic nature of teaching processes, evaluation indicators must be flexible enough to adapt to technological advancements and practical teaching adjustments. Regular reviews and updates should incorporate new important technological applications and pedagogical goals, ensuring the evaluation system aligns with real teaching conditions. For instance, with the increasing application of virtual reality and artificial intelligence in Business English teaching, relevant indicators should be integrated promptly to reflect the trends and effectiveness of teaching developments.

4.2 Three-Dimensional Evaluation Framework

Based on the aforementioned principles, a three-dimensional evaluation framework is established, encompassing technical application adaptability, teaching process effectiveness, and learning outcome attainment.

Technical Application Adaptability: This dimension assesses the compatibility between Internet new media technology and Business English teaching. Specific indicators include the alignment of technological tools with course content—such as whether online live courses effectively present business case

details—and the stability of technical platforms, measured by system failure frequency and lag duration to ensure a smooth teaching process. Additionally, students' acceptance of technological tools can be gauged through surveys on their willingness to use various new media learning tools and their proficiency in using them.

Teaching Process Effectiveness: This dimension focuses on the role of Internet new media technology during the teaching implementation phase. Indicators include the effectiveness of resource integration, measuring how well teachers consolidate various digital resources into cohesive teaching content and the students' satisfaction with those resources. The level of teaching interaction can be quantified by tracking participation in live sessions and the volume of posts and replies in online learning communities. Furthermore, the innovation of teaching methods by educators should be evaluated, assessing their use of new media technologies to conduct diverse teaching activities, such as project-based learning and collaborative inquiry.

Learning Outcome Attainment: This dimension emphasizes measuring students' development in knowledge, skills, and competencies. Knowledge mastery is evaluated through exam results and homework quality, while language application skills are assessed in practical contexts such as speaking, writing, and translation. Business practice skills can be evaluated through simulated business activities and feedback from internships, assessing students' abilities in negotiation, marketing planning, and business communication.

The three-dimensional evaluation system provides a comprehensive and systematic assessment of the impact of Internet new media technology on Business English teaching, offering scientific support for teaching improvement and promoting continuous enhancement of teaching quality.

5. OPTIMIZATION STRATEGIES FOR APPLYING INTERNET NEW MEDIA TECHNOLOGY IN BUSINESS ENGLISH TEACHING

5.1 Strategies for Deep Integration of Technology and Teaching

Building an integrated digital teaching resource library for Business English is a crucial step towards the deep integration of technology and teaching. Educational institutions should organize professional teams to systematically collect, filter, and organize dispersed online resources related to Business English, such as industry news, business cases, and authentic English videos. These resources should be categorized according to the Business English curriculum, ensuring their relevance and timeliness.

Innovating teaching models to create immersive Business English learning environments can significantly enhance students' learning experiences and outcomes. By utilizing virtual reality (VR) and augmented reality (AR) technologies, highly realistic business scenarios can be created, allowing students to role-play and practice Business English communication in simulated environments. Moreover, project-based learning can be implemented, where teachers design Business English content as specific projects, and students work in groups, utilizing Internet new media technologies such as online research and data analysis.

5.2 Strategies for Enhancing Teachers' Digital Literacy

Enhancing teachers' digital literacy is essential for the effective application of Internet new media technology in Business English teaching. Institutions should incorporate digital literacy training into regular operations, developing structured training plans that cover essential digital skills and deep applications of new media technologies in teaching.

Establishing an incentive mechanism for teachers' digital literacy development can further ensure the continuous improvement of their digital skills. Institutions should recognize teachers who actively enhance their digital literacy and effectively apply new media technologies in their teaching, granting them preferential treatment in promotions and performance evaluations.

6. CONCLUSION

This study provides an in-depth analysis of the application of Internet new media technology in Business English teaching and its evaluation system. Given the accelerated global economic integration and the soaring

demand for Business English talent, the rapid development of Internet new media technology presents opportunities for pedagogical reform. By reviewing the current research landscape, it is evident that while international studies yield significant innovations and diversification in technology applications, domestic research tends to focus more on exploring application paths within local educational contexts, both experiencing challenges in the depth of technology and teaching integration.

The outlined evaluation system, encompassing principles for indicator selection and a three-dimensional evaluation framework, allows for a comprehensive assessment of teaching effectiveness, providing scientific basis for optimization. Future research could further explore the application of emerging technologies such as artificial intelligence and blockchain in Business English teaching, as well as strategies for promoting international collaboration and exchange in Business English education through technology.

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Research on the Core Role of Guizhou Red Culture in the Cultivation of Professional Quality of Higher Vocational Students

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Abstract: This study aims to explore the core role of Guizhou's red culture in the cultivation of professional qualities among vocational college students. Through literature research, the theoretical connection between red culture and professional qualities is sorted out. Questionnaire surveys and interviews are used to collect the current data of professional qualities of vocational college students. Combined with the empowerment of digital technology, the value of Guizhou's red culture resources in the cultivation of professional qualities is analyzed. During the research process, big data analysis technology was utilized to explore the connotation of Guizhou's red culture. Through digital means such as virtual simulation, the cultural dissemination path was innovated to investigate its influence on dimensions such as professional ethics, professional skills, and professional spirit of vocational college students. Research shows that the core spirit of hard work, unity and cooperation, and innovation contained in Guizhou's red culture, with the assistance of digital technology, can effectively enhance the professional identity, sense of responsibility and innovation ability of higher vocational students, providing unique and rich spiritual resources and practical paths for the cultivation of professional qualities, which is of great significance to the high-quality development of higher vocational education in the new era.
Key words: Red Culture of Guizhou Vocational college students Professional quality Digital empowerment Talent cultivation

1. PREFACE

1.1 Research Background and Significance

Under the background of deepening the reform of vocational education in the new era, the cultivation of professional qualities of higher vocational students has become a key link in improving the quality of education. the "Action Plan for Improving the Quality and Promoting Excellence in Vocational Education" issued by the Ministry of Education clearly states that vocational education should strengthen the integration of ideological and political education and professional education, and cultivate high-quality technical and skilled talents with both moral integrity and professional skills. As a major province rich in red cultural resources, Guizhou boasts over 200 red cultural sites and relics, including the site of the Zunyi Conference and the Memorial Hall of the Four Crossings of the Chishui River. the revolutionary spirit they carry is a precious resource for nurturing people. Meanwhile, the digital wave is sweeping through the education sector. the 2023 China Education Informatization Development Report shows that the utilization rate of digital teaching resources in vocational colleges has reached 87.6%, and technologies such as virtual reality and big data are deeply reshaping the form of education. In this context, exploring the educational value of Guizhou's red culture and innovating the cultivation model of professional qualities for higher vocational students with the aid of digital technology have significant practical significance.

From a theoretical perspective, the research on the integration of red culture and professional quality education is still in the exploratory stage. Especially from the perspective of digital empowerment, there is a theoretical gap in the construction of the synergy mechanism between the two. This research will fill the gap in theoretical studies in this field and provide new perspectives and ideas for the improvement of the theoretical system

of vocational education. At the practical level, current higher vocational education generally has problems such as the disconnection between professional quality cultivation and professional teaching, as well as a single educational method. According to the research data of the China Vocational Education Society, only 32.4% of higher vocational colleges have established a systematic professional quality cultivation system. Activating the red cultural resources in Guizhou through digital means can provide immersive and interactive teaching scenarios for the cultivation of professional qualities, effectively enhance the effectiveness of education, and promote the high-quality development of vocational education.

1.2 Review of Research Status at Home and Abroad

Research on professional qualities abroad started earlier, focusing on the construction of professional ability standards and evaluation systems. For instance, the "dual system" education in Germany emphasizes the cultivation of professional action capabilities, and the Career and Technical Education Act in the United States has established a core competence framework for professional qualities. However, foreign studies have rarely touched upon the connection between cultural inheritance and professional qualities, and the exploration of the educational function of red culture is almost non-existent.

Research on domestic red culture education has been heating up continuously in recent years. Scholars have explored issues such as the exploration of the connotation of red culture [2] and the integration path of ideological and political education [3], but research focusing on the cultivation of professional qualities for vocational college students is relatively insufficient. Some studies suggest that red culture can enhance students' sense of professional responsibility and dedication, but there is a lack of practical exploration from the perspective of digital empowerment. In the field of digital education, although some studies have focused on the application of virtual simulation and smart education platforms in vocational teaching, a systematic solution that deeply integrates the digital development of red cultural resources with the cultivation of professional qualities has not yet been formed. the fragmented characteristics of the existing research provide theoretical deepening and practical innovation space for this study.

2. THEORETICAL INTERPRETATION OF GUIZHOU'S RED CULTURE AND THE PROFESSIONAL QUALITY OF HIGHER VOCATIONAL STUDENTS

2.1 The Connotation and Characteristics of Red Culture in Guizhou

The red culture of Guizhou takes the spirit of the Long March as its core, integrates the local ethnic cultural characteristics, and forms a unique spiritual spectrum. the ideological line of seeking truth from facts established at the Zunyi Conference, the strategic wisdom demonstrated by crossing the Chishui River four times, and the spirit of sacrifice highlighted by the "Kunniushan Feat" constitute its spiritual core. In terms of cultural form, Guizhou's red culture combines historical and regional characteristics: it not only features revolutionary sites left by the Central Red Army's movement to Guizhou, but also incorporates vivid stories of ethnic minorities such as the Miao and Dong supporting the revolution, thus forming a cultural integration feature of "red+ethnic". This diverse and complex cultural trait gives it a unique advantage in shaping values and cultivating historical identity, providing rich materials for professional quality education.

2.2 Constituent Elements of Professional Qualities of Vocational College Students

The professional quality of vocational college students is an organic unity of professional ethics, professional skills and professional spirit. At the professional ethics level, it covers core values such as honesty and trustworthiness, responsibility and commitment; Vocational skills include practical qualities such as professional operation ability and problem-solving ability; Professional spirit emphasizes the spirit of craftsmanship, innovative consciousness and teamwork ability. According to a survey by Mycos Research Institute, among the demands of enterprises for the professional qualities of vocational college graduates, responsibility (89.7%), communication skills (85.3%), and learning ability (83.1%) rank the top three. This compound quality structure requires

vocational education to break through the single skill training model and shift to a comprehensive education system that combines moral and technical cultivation.

2.3 Theoretical Basis for the integration of the two

From the perspective of pedagogy, the constructivist learning theory emphasizes the importance of context for knowledge construction. the historical scenes and value concepts contained in the red culture of Guizhou can create real learning contexts for the cultivation of professional qualities. the theory of internalization of values in the field of psychology points out that cultural identity is the key to the formation of values, and the spiritual appeal of red culture helps students internalize professional norms into conscious actions. From the theoretical perspective of vocational education, the concept of "all-round education for all" requires the establishment of an education pattern that involves all personnel, the entire process, and all aspects. the integration of red cultural resources can achieve the same direction and progress of ideological and political education and professional teaching, forming a collaborative education effect.

3.ANALYSIS OF THE CURRENT SITUATION OF INTEGRATING GUIZHOU'S RED CULTURE INTO THE CULTIVATION OF PROFESSIONAL QUALITIES OF HIGHER VOCATIONAL STUDENTS

3.1 Integrate the current situation investigation methods and data sources

The research adopted a mixed research method and conducted a survey in 12 vocational colleges in Guizhou Province. Through stratified sampling, 1, 200 questionnaires were distributed, and 1, 123 valid questionnaires were retrieved, with an effective recovery rate of 93.6%. Thirty teachers and fifty students were selected for in-depth interviews. the questionnaire designs scales from dimensions such as curriculum design, teaching methods, and resource development, and the interviews focus on the difficulties in integrating red culture into practice. Data analysis was conducted using SPSS 26.0 software. the reliability of the data was ensured through reliability and validity tests. the Cronbach's α coefficient was 0.826, verifying the effectiveness of the measurement tool.

3.2 Existing Integration Models and Achievements

At present, three typical integration models have been formed in higher vocational colleges in Guizhou: the course embedding model, which incorporates red culture into the teaching content of ideological and political courses and professional courses. For example, a certain vocational college has integrated the practical training of explaining the site of the Zunyi Conference into the "Tourism Service and Management" course. the practical experience mode organizes students to conduct on-site research and study at red heritage sites, with an average of over 20, 000 participants per year. the cultural immersion model creates an educational atmosphere through red-themed club activities and artistic performances. the survey shows that 78.6% of the students believe that the study of red culture has enhanced their sense of professional mission, and 65.3% of the teachers report that the students' teamwork ability has significantly improved.

3.3 Existing Problems and Challenges

Despite certain achievements, the integration practice still faces multiple predicaments. At the level of resource development, the fragmentation of red cultural resources is severe, and only 23.8% of the institutions have established systematic resource libraries. At the level of teaching methods, 76.4% of the classrooms still mainly rely on traditional lectures, and the application of digital teaching means is insufficient. At the evaluation mechanism level, 81.2% of the institutions have not established special evaluation indicators for red culture education. In addition, the problem of unbalanced regional development is prominent. In ethnic minority areas such as Qiandongnan, due to the shortage of teachers and weak technology, the educational effectiveness of red culture is significantly lower than that of educational institutions in cities like Guiyang and Zunyi.

4. MECHANISM OF GUIZHOU RED CULTURE IN CULTIVATING VOCATIONAL COMPETENCE OF HIGHER VOCATIONAL STUDENTS

UNDER DIGITAL EMPOWERMENT

4.1 Connotation and Value of Digital Empowerment

Digital empowerment reconstructs the educational ecosystem through technological innovation, focusing on data-driven approaches, scenario reconstruction, and model innovation. In vocational education, digital technologies enable the precise collection, structured storage, and intelligent dissemination of red culture resources, overcoming spatiotemporal limitations. For instance, VR technology allows students to "experience" the Chishui River battle, enhancing immersion in learning. Data from the Ministry of Education's benchmark institutions in vocational education show that the use of digital teaching tools increases knowledge retention by 37% and boosts student interest by 42%.

4.2 Pathways of Red Culture in Enhancing Vocational Competence

Red culture impacts vocational competence through three dimensions: cognitive construction, emotional resonance, and behavioral shaping. Cognitively, stories of red culture reflect vocational norms, such as the "Half a Quilt" story illustrating service consciousness. Emotionally, the deeds of revolutionary predecessors foster students' professional identity, with surveys indicating a 58.3% increase in clarity of vocational aspirations after exposure to red culture. Behaviorally, red culture practice activities encourage students to translate values into vocational actions, such as teamwork in red-themed research activities.

4.3 Empowerment of Digital Technologies in the Process

Big data technologies analyze student learning behavior data to accurately recommend red culture learning resources. AI supports virtual mentoring systems for personalized learning guidance, while blockchain ensures copyright protection and traceability of digital red culture resources. For example, a vocational college developed the "Red Cloud Classroom" platform, using AI semantic analysis to tailor red culture case studies to students' specialties, resulting in a 61% increase in course completion rates compared to traditional methods. the integration of digital technologies shifts red culture education from experience-driven to data-driven, and from generalized to personalized training.

5. STRATEGIES FOR INTEGRATING DIGITAL EMPOWERMENT OF GUIZHOU RED CULTURE INTO VOCATIONAL COMPETENCE DEVELOPMENT

5.1 Build a Digital Red Culture Resource Database

Integrate resources such as Guizhou's red sites, revolutionary artifacts, and oral histories to establish a multimodal database using 3D modeling and high-definition imaging. Utilize metadata standards for resource classification and create a correspondence index between "red spirit" and vocational competence, linking events like the "Breakthrough of the Wujiang River" to the qualities of resilience. Facilitate collaboration with intelligent education platforms for cross-institutional resource sharing and dynamic updates. the "Red Movement in Qian" digital resource project in Guizhou aims to establish a comprehensive red culture digital resource network within three years.

5.2 Innovate Digital Teaching Models

Develop virtual simulation teaching projects centered on red culture, such as "Retracing the Long March" VR training and AR workshops for red cultural creative design. Implement a comprehensive teaching model using learning analytics that includes pre-class diagnostics, in-class interactions, and post-class assessments. For instance, one college recreated the construction of the Red Army bridge in the "Construction Engineering Technology" course through virtual simulation, guiding students towards engineering skills and craftsmanship. Promote blended learning by integrating online red culture micro-courses with offline practical activities to create a learning cycle of "online cognition-offline experience-online deepening. "

5.3 Refine the Digital Evaluation System

Establish a "process+value-added" evaluation model using a learning behavior analysis system to capture frequency, duration, and interaction data of students engaging with red culture learning. Create a vocational competence development radar chart for visual assessment across dimensions such as

professional ethics and skills. Incorporate blockchain technology for data verification to ensure objectivity in results. After piloting a digital evaluation system, one vocational institution saw the reliability coefficient of vocational competence assessments rise from 0.71 to 0.89, enhancing the scientific rigor and fairness of evaluations.

6. CONCLUSION

This study confirms the central role of Guizhou red culture in cultivating vocational competence among higher vocational students, demonstrating that digital empowerment significantly enhances educational effectiveness. Theoretical construction and empirical analysis reveal the intrinsic connection between red culture and vocational competence, proposing practical paths such as resource database development, innovative teaching models, and improved evaluation systems. the findings indicate that digital technology can transcend the spatiotemporal limitations of red cultural education, enriching learning experiences through immersion and interactivity, and providing a new paradigm for vocational competence cultivation.

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Research on Training Pathways for Badminton in Higher Education Institutions in Sub-Plateau Regions

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Abstract: To enhance the scientific nature and effectiveness of badminton training in higher education institutions within sub-plateau regions, this study employs literature review, theoretical analysis, and logical induction. It explores how geographical and climatic conditions impact athletes' physiological functions and performance, while systematically investigating optimal training pathways tailored to the sport's characteristics. The findings indicate that the sub-plateau environment positively affects athletes' cardiovascular function yet may compromise the stability of technical movements. Therefore, it is suggested to scientifically plan training content, rationally adjust the ratio of aerobic to anaerobic training, and strengthen adaptive training and technical refinement. The study concludes that badminton training in these regions should leverage environmental advantages, develop personalized training programs, and enhance monitoring and evaluation systems to maximize training outcomes.

Keywords: Sub-plateau regions; University badminton; Training pathways; Physiological functions; Training optimization

1. INTRODUCTION

1.1 Research Background and Significance

Against the backdrop of the "Healthy China 2030" strategy and the continuous implementation of "education-sports integration" policies, the role of physical education in talent development in universities has become increasingly significant. Badminton, characterized by both competitiveness and mass participation, occupies a crucial position in university sports education and training. Sub-plateau regions (elevation 1500-2500 meters) present unique geographical and climatic challenges and opportunities for sports training, directly impacting the physical fitness and competitive levels of students.

The lower air pressure and thinner air in sub-plateau areas, with oxygen content only 75%-85% of that at sea level, significantly alter athletes' metabolic mechanisms. Scientific utilization of these environmental characteristics in badminton training can yield unique benefits in endurance enhancement and cardiovascular function strengthening. However, improper training methods may lead to technical distortions and rapid fatigue accumulation. Investigating badminton training pathways in sub-plateau regions not only aids in optimizing training systems but also provides theoretical and practical insights for other sports in similar environments, contributing to the balanced development of physical education in China.

1.2 Review of Domestic and International Research

International research on sub-plateau and high-altitude training has advanced earlier, focusing on how such environments affect athletes' physiological functions. For instance, studies by the American College of Sports Medicine (ACSM) confirm a 10%-20% increase in erythropoietin secretion during training at elevations of 1800-2500 meters, enhancing oxygen transport capacity. In badminton training, countries like Denmark and Malaysia have explored environmental adaptability through low-oxygen training chambers, investigating athletes' performance changes under hypoxic conditions; however, many of these studies are based on laboratory simulations rather than real-world sub-plateau training scenarios.

Domestically, research on sports training in sub-plateau areas has gradually deepened in recent years, with some scholars discussing

training patterns for athletics and football, proposing strategies such as "step training" and "living high, training low." In badminton, existing research mainly focuses on optimizing training methods and analyzing technical movements in plain regions, with a relative lack of systematic studies on university badminton training in sub-plateau areas. While a few studies address the impact of sub-plateau environments on badminton athletes' endurance, comprehensive analyses of training plans, technical adjustments, and support systems are lacking. These gaps highlight the necessity of establishing a scientific training pathway for badminton in sub-plateau regions.

2. ENVIRONMENTAL CHARACTERISTICS OF SUB-PLATEAU REGIONS AND THEIR IMPACT ON BADMINTON TRAINING

2.1 Analysis of Sub-Plateau Geographical and Climatic Conditions

Sub-plateau regions are located at elevations of 1500-2500 meters, where air pressure decreases non-linearly with altitude. For example, at 2000 meters, air pressure is around 79 kPa, approximately 20% lower than at sea level. Air density and oxygen content also decrease, leading to a significant reduction in the amount of oxygen retrieved per breath. Furthermore, UV radiation levels are 30%-40% higher than in plains, with a diurnal temperature variation of 10°C-15°C. These complex climatic conditions impose higher demands on athletes' adaptability and training arrangements.

2.2 Impact of Sub-Plateau Environment on Athletes' Physiological Functions

The low-oxygen environment of the sub-plateau prompts the body to initiate compensatory mechanisms, initially causing increased heart rates and respiratory frequencies. With long-term training, the body enhances its oxygen-carrying capacity by increasing red blood cell counts and hemoglobin concentrations. Research indicates that after 6-8 weeks of training in sub-plateau conditions, athletes' hemoglobin levels can rise by 8-12 g/L. Additionally, the sub-plateau environment stimulates mitochondrial biogenesis, enhancing aerobic metabolism and endurance. However, low-oxygen conditions can also affect the nervous system's control over muscle precision, leading to decreased coordination and accuracy in executing complex badminton techniques, necessitating targeted training to mitigate these negative effects.

2.3 Opportunities and Challenges of Sub-Plateau Environment for Badminton Training

The sub-plateau environment presents unique opportunities for badminton training. Endurance training in low-oxygen conditions can effectively enhance athletes' cardiovascular function and anaerobic thresholds. Upon returning to sea level competitions, athletes benefit from the "high-altitude training effect," maintaining higher exercise intensity in later stages of matches. Nonetheless, there are challenges, as low oxygen levels extend recovery times by 30%-50%, and improper management of training intensity and recovery may lead to overtraining and injuries. Moreover, the thinner air decreases air resistance for the shuttlecock, increasing its speed, which requires athletes to readjust their striking force and timing, imposing new demands on technical training.

3. THEORETICAL FOUNDATIONS FOR BADMINTON TRAINING IN SUB-PLATEAU REGIONS

3.1 Support from Exercise Physiology

Exercise physiology indicates that low-oxygen environments activate hypoxia-inducible factors (HIF), promoting erythropoietin (EPO) secretion and accelerating red blood cell production and hemoglobin synthesis, thereby enhancing blood oxygen transport capacity. Low-oxygen training can also improve mitochondrial function and increase muscle tissue's oxygen uptake and utilization efficiency. These physiological changes provide a theoretical basis for improving endurance qualities in badminton training within sub-plateau regions. By scientifically designing low-oxygen training intensities and durations, the aerobic metabolic capabilities of athletes can be enhanced.

3.2 Principles of Exercise Training

Exercise training emphasizes the systematic and periodic nature of training plans. In

badminton training in sub-plateau regions, it is essential to adhere to the "supercompensation" principle, effectively arranging training loads and recovery times. Given that athletes accumulate fatigue faster in sub-plateau environments, a "wave-like" load distribution should be employed, providing ample recovery periods after high-intensity training to avoid overtraining. Furthermore, considering the characteristics of badminton, it is crucial to integrate technical, tactical, and physical training, establishing a training system suited to the sub-plateau environment.

3.3 Environmental Adaptation Training Theory

Environmental adaptation training theory suggests that the human body undergoes an adaptation process to environmental changes. By gradually increasing environmental stimuli, the body's adaptability can be enhanced. In badminton training within sub-plateau regions, a "progressive adaptation training" strategy can be adopted, initially reducing training intensity to allow athletes sufficient time to adapt to the low-oxygen environment, then gradually increasing training loads to match athletes' physiological capabilities and training demands. Concurrently, training content and methods should be adjusted in line with environmental characteristics to achieve collaborative optimization.

4. ANALYSIS OF BADMINTON TRAINING STATUS IN HIGH-ALTITUDE PLATEAU UNIVERSITIES

4.1 Training Objectives and Planning

A survey of badminton training in ten universities in high-altitude plateau regions reveals that 60% focus primarily on enhancing students' physical health, while only 40% include competitive performance in their objectives. Most universities use fixed training cycles without considering the unique challenges of the plateau environment. Aerobic endurance training constitutes 65% of the training cycle, while specialized training for technical stability in low-oxygen conditions is insufficient, leading to frequent technical errors during competitions.

4.2 Current Training Content and Methodologies

Training content predominantly consists of basic technical skills (serving, receiving, clear shots), accounting for 70% of total training time, with tactical and physical training being relatively minimal. Traditional repetitive training methods are common, lacking innovation. The physical training approach fails to leverage plateau advantages, relying on plains-based training models, which limits the development of athletes' endurance potential. Additionally, there is inadequate emphasis on coordination training in low-oxygen environments, hindering athletes' performance in competitive settings.

4.3 Current Training Support System

The training support system in high-altitude plateau universities generally faces resource shortages. The survey indicates that 75% lack specialized sports physiology monitoring equipment, impairing real-time tracking of athletes' training status and physiological changes. Furthermore, some badminton facilities suffer from poor ventilation, exacerbating athletes' hypoxia symptoms. Only 30% of the coaching staff possess expertise in plateau training, failing to meet scientific training needs. Limited funding restricts the introduction of advanced training methods and equipment.

5. OPTIMIZING BADMINTON TRAINING IN HIGH-ALTITUDE PLATEAU UNIVERSITIES

5.1 Adjusting Training Objectives and Plans Based on Environmental Features

Reconstruct the training objective system to prioritize adaptability to plateau conditions, endurance enhancement, and technical stability. Employ a "dynamic periodization training method," segmenting training cycles according to athletes' acclimatization stages. The acclimatization phase (1-2 weeks) should involve reduced intensity focused on low-oxygen adaptation; the enhancement phase (3-6 weeks) should increase aerobic endurance and specialized technical training intensity; and the pre-competition adjustment phase (1-2 weeks) should simulate competition intensity to refine technical actions and tactical coordination, aligning closely with environmental characteristics.

5.2 Designing Scientific Training Content and Methods

Expand training content to include specialized technical training for the plateau environment,

such as rapid response training and precision control under low-oxygen conditions, raising its share to 30% of total training time. Adopt a "low-oxygen-normal oxygen alternating training method," incorporating aerobic endurance training in high-altitude conditions along with high-intensity interval training in low-oxygen chambers to enhance anaerobic capacity. Integrate smart training devices to analyze athletes' movement trajectories and correct technical deviations specific to low-oxygen environments.

5.3 Enhancing Training Monitoring and Evaluation System

Establish a multidimensional training monitoring system equipped with portable sports physiology monitoring devices to track athletes' heart rate variability and blood oxygen saturation in real-time, providing data support for adjusting training intensity. Develop a training effect evaluation model that quantifies performance across physical (endurance, speed, strength), technical (accuracy, stability), and tactical indicators (success rate of tactical execution). Implement a phased evaluation and feedback mechanism to adjust training plans and methods based on assessment results.

5.4 Optimizing Training Support Strategies

Increase resource investment in training, improve ventilation conditions in badminton facilities, and equip with low-oxygen training chambers and monitoring devices. Enhance faculty development by providing regular specialized training for coaches in plateau training techniques. Establish partnerships with enterprises to tap into social resources, such as obtaining equipment sponsorships from sports brands and collaborating with medical institutions to create injury prevention and rehabilitation systems, ensuring comprehensive support for badminton training in high-altitude plateau universities.

6. CONCLUSION

This study systematically explores training pathways for badminton in high-altitude plateau universities, identifying the dual influence of the plateau environment on training. By scientifically leveraging environmental advantages, adjusting training objectives and plans, optimizing content and methods, and enhancing monitoring and support systems, the quality of badminton training in these regions can be effectively improved. Future research may delve deeper into personalized training programs for athletes in high-altitude environments and the long-term assessment of training effects, providing more comprehensive theoretical and practical support for the development of badminton in high-altitude plateau universities.

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Research on the Reform of Practical Teaching in Pharmaceutical Major under the Background of New Engineering

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Abstract: In the context of the new engineering education emphasizing interdisciplinary integration, innovation capability cultivation, and alignment with industry demands, the practice teaching in pharmaceutical education requires urgent reform to nurture high-quality talent suitable for industry development. This study employs literature analysis, theoretical deduction, and expert interviews to systematically explore reform pathways for practice teaching in pharmaceutical education under the new engineering context. Firstly, it identifies issues such as fragmented curriculum systems, insufficient depth of industry-university integration, and an incomplete evaluation system for practical teaching. Secondly, based on the core concepts of "innovation-driven, cross-disciplinary integration, and practice-oriented" in new engineering education, it proposes the establishment of a modular, multi-tiered practical curriculum system, deepening the collaboration mechanism between universities and enterprises, incorporating virtual simulation technologies to create a blended practical teaching platform, and improving a diversified evaluation system oriented towards competence. Finally, through theoretical validation and logical reasoning, it verifies the effectiveness of these reform measures in enhancing students' practical innovation capabilities, strengthening professional competence, and increasing industry adaptability. The findings suggest that the reform of practice teaching in pharmaceutical education under the new engineering context should leverage industry-university integration as a link, focus on cultivating innovation capabilities, and optimize teaching systems and models to comprehensively improve the quality of practice teaching.

Keywords: New Engineering; Pharmaceutical Education; Practice Teaching; Teaching Reform; Industry-University Integration

1. INTRODUCTION

1.1 Research Background and Significance

The global biopharmaceutical industry is undergoing rapid transformation, driven by breakthroughs in cutting-edge technologies such as gene editing, AI drug design, and synthetic biology, promoting a shift towards smarter and more precise pharmaceutical practices. China's "14th Five-Year Plan" for the pharmaceutical industry emphasizes the acceleration of key technology breakthroughs and enhancing industry innovation capabilities, raising higher requirements for talent cultivation in pharmaceutical education. As a crucial direction for reform in higher engineering education, new engineering education aims to be industry-driven, fostering interdisciplinary integration and cultivating engineering talent with innovation capabilities and international competitiveness. Under this framework, the practice teaching in pharmaceutical education must transcend traditional models and construct a teaching system aligned with new engineering principles.

Traditional pharmaceutical practice teaching has primarily focused on drug production processes and basic experimental skill training, lacking in fostering interdisciplinary thinking and applying cutting-edge technologies. Research indicates that only 32% of 127

surveyed institutions offering pharmaceutical engineering programs incorporate emerging technologies such as AI-assisted drug development into their practical courses. This disconnect from the rapidly evolving industry needs has resulted in graduates lacking the necessary problem-solving and innovative practical skills required by the sector. Therefore, investigating the reform of practice teaching in pharmaceutical education under the new engineering framework is crucial for improving talent cultivation quality and fostering innovation within the pharmaceutical industry.

1.2 Review of Domestic and International Research Status

Internationally, pharmaceutical engineering education reform has been underway for some time. The U.S. Accreditation Board for Engineering and Technology (ABET) includes engineering ethics, interdisciplinary collaboration, and lifelong learning in its accreditation standards, driving reforms in practice teaching. Some UK universities have developed "industry project-driven" practice teaching models, collaborating closely with pharmaceutical companies on drug development projects to enhance students' practical innovation abilities. Japanese universities emphasize collaboration between academia and industry, establishing joint laboratories and offering internships to strengthen students' engineering practice skills.

Since the launch of new engineering education in China in 2017, research on reforming practice teaching in pharmaceutical education has gradually gained attention. Scholars have explored various dimensions, including curriculum optimization, deepening industry-university integration, and innovating teaching methods. Some studies propose a progressive curriculum framework of "fundamental practice-professional practice-innovative practice" to enhance students' practical skills, while others emphasize establishing joint training bases between universities and enterprises to align talent cultivation with industry needs. However, existing research tends to focus on singular reform paths, with a lack of systematic studies on the reforms in pharmaceutical practice teaching under the new engineering context, particularly in integrating emerging technologies and constructing interdisciplinary teaching platforms. Additionally, research on the supporting mechanisms during the implementation of teaching reforms remains insufficient.

2. CURRENT STATUS ANALYSIS OF PRACTICE TEACHING IN PHARMACEUTICAL EDUCATION UNDER NEW ENGINEERING

2.1 Goals of Pharmaceutical Practice Teaching

The primary goal of practice teaching in pharmaceutical education is to equip students with professional skills in drug development, production, and quality control, while enabling them to analyze and solve real-world pharmaceutical engineering problems. Under the new engineering context, the aim expands to cultivating interdisciplinary talents capable of adapting to the pharmaceutical industry's shift toward intelligent transformation. Students are expected to master knowledge in chemistry, biology, and pharmacy while also possessing the ability to utilize emerging technologies such as AI and big data in drug development and production, alongside teamwork, communication, and continuous learning skills.

2.2 Main Issues in Current Practice Teaching

The issue of fragmented curriculum systems is prominent. Current practical courses are often based on a single discipline, lacking organic connections between courses, making it difficult to form a comprehensive knowledge system. For instance, courses in medicinal chemistry, pharmaceutical technology, and pharmacology operate independently, leading to challenges in applying interdisciplinary knowledge to practical problem-solving. A survey of graduates in pharmaceutical engineering revealed that 65% of students believe practical courses lack systematization and fail to meet the demands for solving complex engineering problems.

Insufficient depth of industry-university integration is another challenge. Collaboration often remains at the level of student internships, with limited enterprise involvement in practical course design, faculty development, and teaching evaluation.

The introduction of real-world projects into the classroom is minimal, resulting in a gap between practiced content and cutting-edge industry technologies. Statistics indicate that the proportion of joint development of practice courses between universities and enterprises in China's pharmaceutical field is below 20%.

Moreover, the evaluation system for practice teaching is underdeveloped. Current assessments primarily focus on traditional methods such as lab reports and practical skills assessments, emphasizing knowledge mastery and skill execution while neglecting evaluations of innovation capability, teamwork, and ethical awareness. This singular evaluation approach fails to fully reflect students' comprehensive qualities and hinders the cultivation of their innovative practical abilities.

3. NEW REQUIREMENTS AND CHALLENGES FOR PHARMACEUTICAL PRACTICE TEACHING UNDER NEW ENGINEERING

3.1 Core Concepts and Characteristics of New Engineering

New engineering education is characterized by its core ideas of "innovation-driven, cross-disciplinary integration, practice-oriented, and future-facing," emphasizing the breaking down of disciplinary barriers and the deep integration of engineering education with emerging technologies and industry demands. Its features include a focus on cultivating students' innovative thinking and practical abilities, promoting interdisciplinary integration, and constructing dynamic curricula that adapt to industry changes; emphasizing collaborative education with enterprises centered on real engineering problems; and valuing engineering ethics education to cultivate engineering talents with social responsibility and a global perspective.

3.2 New Requirements for Pharmaceutical Practice Teaching under New Engineering

In the context of new engineering, comprehensive reform is required in curriculum systems, teaching methods, and faculty development for pharmaceutical practice teaching. The curriculum must integrate emerging technologies such as AI drug design, synthetic biology, and smart pharmaceutical equipment, creating interdisciplinary practical course modules. Teaching methods should adopt student-centered approaches like project-based learning and case teaching to enhance comprehensive abilities through real problem-solving. Faculty development needs to focus on building a team with interdisciplinary knowledge and industry experience to guide students in practical applications of cutting-edge technologies. However, currently, less than 30% of faculty in pharmaceutical programs have enterprise work experience, which is insufficient to meet the demands of new engineering practice teaching.

4. REFORM STRATEGIES FOR PHARMACEUTICAL PRACTICE EDUCATION UNDER THE NEW ENGINEERING DISCIPLINE FRAMEWORK

4.1 Development of a Modular, Multi-level Practical Curriculum System

In response to the requirements for talent cultivation in pharmaceutical disciplines within the context of new engineering, a modular curriculum system comprising "Basic Practice Module-Professional Practice Module-Innovative Practice Module" should be established. The Basic Practice Module includes foundational courses such as chemistry and biology labs, aimed at fostering students' fundamental experimental skills and scientific literacy. The Professional Practice Module encompasses specialized laboratory courses like drug synthesis, formulation, and quality control, enhancing students' professional competencies. The Innovative Practice Module features interdisciplinary projects such as AI drug design and synthetic biology drug development, aiming to cultivate students' innovative capabilities and problem-solving skills for complex engineering challenges. For instance, real-world drug development projects from industry can be integrated into the Innovative Practice Module, allowing students to apply AI algorithms for drug target prediction and molecular design, thereby enhancing their capacity to leverage cutting-edge technologies.

4.2 Strengthening Collaborative Education Mechanisms between Universities and

Enterprises

A collaborative education platform involving deep partnerships with enterprises should be developed, engaging them in the entire practical teaching process. During the course design phase, industry experts will co-develop practical teaching outlines to incorporate production standards and advanced technologies into the curriculum. In the teaching implementation phase, industry engineers can serve as adjunct faculty, working alongside university instructors to guide student practice. In the evaluation phase, industry evaluation metrics will assess students on various dimensions, including practical outcomes, professional qualities, and teamwork skills. Additionally, joint laboratories and internship bases can be established to provide authentic engineering practice environments. For example, a university may collaborate with a renowned pharmaceutical company to co-build an intelligent pharmaceutical laboratory, where students can engage in projects related to the optimization of intelligent drug production processes.

4.3 Establishing a Hybrid Virtual and Physical Practical Teaching Platform

Utilizing emerging technologies such as virtual simulation and digital twins, a hybrid practical teaching platform should be developed. This platform will feature a comprehensive virtual simulation project for drug development, covering drug design, synthesis, formulation, and quality control, allowing students to conduct complex experimental operations and process optimizations in a virtual environment, thus reducing costs and safety risks. Simultaneously, it will complement physical laboratory teaching, combining the advantages of both virtual simulations and actual experiments. For example, in drug synthesis labs, students can first optimize reaction conditions through the virtual platform before validating them in physical labs, thereby enhancing efficiency and success rates. An online resource platform for practical teaching can also be introduced, offering abundant teaching videos, virtual experiment projects, and online assessments to support student autonomous learning and personalized development.

4.4 Enhancing a Diversified Practical Teaching Evaluation System

A diversified practical teaching evaluation system should be constructed, incorporating process evaluation, outcome evaluation, and enterprise evaluation. Process evaluation will focus on students' engagement, teamwork, and problem-solving abilities during experiments, using methods such as classroom performance tracking and peer reviews. Outcome evaluation will be based on experimental reports, practical projects, and presentations, assessing students' knowledge retention and skill application. Enterprise evaluation will involve industry experts assessing students' performance during internships and collaborative projects, with a focus on professional conduct and practical abilities. Each evaluation dimension will be weighted to provide a comprehensive assessment of students' practical learning outcomes. For instance, in a collaborative drug development project evaluation, process evaluation may account for 30%, outcome evaluation for 40%, and enterprise evaluation for 30%, guiding students towards holistic development through diversified assessments.

5. IMPLEMENTATION SUPPORT FOR PHARMACEUTICAL PRACTICE EDUCATION REFORM

5.1 Faculty Development

Strengthening faculty development is crucial for the reform of practical education. Teachers should be encouraged to engage in industry practices through opportunities such as secondments and collaborative research projects, thereby enhancing their practical capabilities. For example, universities can sign agreements with companies to send a certain percentage of faculty members annually to participate in drug development and production projects to gain engineering experience. Additionally, high-level talents with industry backgrounds should be recruited to enrich the faculty. Cross-disciplinary training for faculty should also be organized, allowing participation in courses on emerging technologies such as AI and synthetic biology to broaden teaching expertise. Furthermore, a dual mentorship system involving both enterprise engineers and university faculty should be established to leverage their

respective strengths in guiding students.

5.2 Institutional and Resource Assurance

Improved management systems for practical education should be established, including the formulation of implementation plans for educational reform, management regulations for university-enterprise cooperation, and quality monitoring and evaluation systems for practical teaching to provide institutional support. Increased investment in practical teaching resources is essential, including the establishment of modern laboratories and the procurement of advanced equipment and software to meet the needs of emerging technology education. For instance, an AI drug development laboratory could be created, equipped with high-performance computing servers and drug design software. Additionally, enhancing the informatization of practical education through the development of an online management platform can facilitate experiment scheduling, resource sharing, and process monitoring. Special funding should also be allocated for reform initiatives supporting course development, pedagogical research, and student innovation projects, ensuring smooth reform progress.

6. CONCLUSION

The reform of pharmaceutical practice education under the new engineering framework is a necessary response to industry development demands and the enhancement of talent cultivation quality. By constructing a modular, multi-level practical curriculum system, deepening university-enterprise collaborative education mechanisms, establishing a hybrid practical teaching platform, and improving a diversified evaluation system—along with strengthening faculty development and institutional resource support—students' innovative capabilities and overall competencies can be effectively enhanced. This approach will achieve a synergistic integration of pharmaceutical education and industrial development. Moving forward, with the continuous growth of the biopharmaceutical industry and the emergence of new technologies, ongoing deepening of these reforms is required to explore new talent cultivation models aligned with industry transformations, providing robust talent support for the innovative development of China's pharmaceutical industry.

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Research on Pathways to Enhance Social Service Capacity of Higher Vocational Nursing Programs in the Context of Building Demonstration Zones for Common Prosperity

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Abstract: Enhancing the social service capacity of higher vocational nursing programs is crucial for optimizing regional health service supply and promoting social equity in the construction of demonstration zones for common prosperity. This study aims to explore effective pathways for improving this capacity. By systematically reviewing relevant theories and practical outcomes from domestic and international literature, a comprehensive evaluation index system for social service capacity in higher vocational nursing is established, followed by an in-depth analysis of its influencing factors. The research considers policy orientation, regional health demands, and institutional resource endowments, identifying issues such as mismatches in service content and demand, insufficient collaboration, and the lack of sustainable mechanisms. Findings suggest constructing enhancement pathways from five dimensions: strengthening policy guidance, deepening industry-education integration, optimizing curriculum systems, enhancing faculty development, and improving evaluation mechanisms. Specifically, resource integration should be facilitated through policy collaboration, service platforms should be expanded via industry-education integration, curriculum reforms should enhance service relevance, faculty training should improve service quality, and dynamic evaluations should ensure service effectiveness, thereby aligning the social service capacity of higher vocational nursing with the needs of common prosperity demonstration zone construction.

Keywords: Common Prosperity Demonstration Zone; Higher Vocational Nursing; Social Service Capacity; Enhancement Pathways; Industry-Education Integration

1. INTRODUCTION

1.1 Research Background and Significance

In advancing the construction of socialism with Chinese characteristics, common prosperity has become one of the core strategic goals of national development. Following the release of the 2021 opinion by the Central Committee of the Communist Party of China and the State Council to support high-quality development in Zhejiang to build a demonstration zone for common prosperity, theoretical advocacy has transitioned into practical exploration. Common prosperity emphasizes comprehensive development and sharing of results across economic, social, cultural, and ecological domains, aiming to narrow disparities in regions, urban-rural divides, and income levels to achieve social equity and sustainable development.

Health is a fundamental guarantee for achieving common prosperity, with nursing services being a critical component of the healthcare system that directly impacts public health and quality of life. As China's population ages and the incidence of chronic diseases rises, along with increasing health awareness, the demand for nursing services has surged in both quantity and diversity. This demand extends beyond traditional clinical care to include community nursing, geriatric

care, rehabilitation, and maternal-child care, necessitating higher professional skills and comprehensive quality from nursing personnel.

Higher vocational nursing education bears the responsibility of cultivating applied nursing talents, and its social service capacity not only influences the quality of talent development but also relates to the improvement of the regional health service system and the promotion of common prosperity demonstration zone construction. However, current issues such as disconnection between service content and demand, insufficient industry-education integration, and weak practical capabilities of faculty hinder the full realization of its social service functions. Therefore, studying pathways to enhance the social service capacity of higher vocational nursing is of significant practical and theoretical value for optimizing nursing resource allocation, reducing health service disparities, and promoting vocational education reform.

1.2 Review of Domestic and International Research

Internationally, vocational education, particularly in nursing, has matured, accumulating substantial experience in social service. For instance, nursing programs at community colleges in the U.S. collaborate closely with communities and healthcare facilities to design training courses based on local health needs, effectively combining talent development with social service. The U.K.'s vocational education emphasizes industry standards through apprenticeship models, enhancing nursing students' skills in practice and facilitating their rapid integration into social service roles post-graduation. Similarly, Australia's TAFE system utilizes information technology to create remote nursing training platforms, increasing service accessibility.

In China, research on the social service capacity of higher vocational nursing programs has increased with the advancement of vocational education and the Healthy China strategy. Existing studies indicate that higher vocational nursing programs have begun to engage in health education and support for nursing institutions but face challenges such as limited scope and quality of services. Many scholars advocate for enhancing capacity through deeper industry-education integration, curriculum optimization, and faculty development. However, there is a lack of systematic research on pathways to enhance social service capacity within the context of common prosperity demonstration zones, and empirical analyses are relatively insufficient, failing to adequately connect the objectives of common prosperity with the functional positioning and development pathways of higher vocational nursing programs.

1.3 Research Purposes and Content

This study aims to analyze the current state, problems, and causes of social service capacity in higher vocational nursing programs against the backdrop of common prosperity demonstration zone construction, and to develop a scientifically effective pathway for capacity enhancement. The research will clarify core concepts such as higher vocational nursing, social service capacity, and common prosperity demonstration zones; investigate the current status of social services provided by higher vocational nursing programs; assess service effectiveness; analyze existing issues and causes; and construct pathways for capacity enhancement from five dimensions: policy guidance, industry-education integration, curriculum system, faculty development, and evaluation mechanisms.

2. RELEVANT CONCEPTS AND THEORETICAL FOUNDATION

2.1 Core Concept Definitions

Higher vocational nursing programs are a vital part of higher vocational education, aiming to cultivate applied nursing talents who possess solid theoretical knowledge, skilled practice, and good professional ethics to work in clinical nursing, community health services, and long-term care. The education emphasizes practical training closely aligned with job market demands.

Social service capacity refers to the ability of higher vocational institutions to utilize their faculty, teaching facilities, and professional knowledge to provide training for nursing talents, nursing services, health promotion, disease prevention, and participation in public health services, reflecting the level and contribution of these institutions to society.

Common prosperity demonstration zones are pilot areas for the national strategy of common prosperity, aiming to explore effective paths and models for achieving common prosperity through coordinated development across economic, social, cultural, and ecological domains. In the health sector, there is a commitment to building a high-quality, equitable healthcare service system, which places increased demands on the social service capacity of higher vocational nursing programs.

2.2 Theoretical Foundations

Human capital theory posits that investments in education and training translate into human capital, enhancing individual productivity and economic value. Higher vocational nursing programs cultivate high-quality nursing talents who can provide excellent services upon entering society, fostering economic and social benefits, advancing health initiatives, and promoting common prosperity.

Synergy theory emphasizes the collaborative effects generated by subsystems within a system, achieving overall functional optimization. Enhancing the social service capacity of higher vocational nursing involves multiple stakeholders, including schools, hospitals, enterprises, and government. Only through strengthened collaboration and resource integration can a cohesive effort be formed to improve the overall efficacy of social services.

Service-learning theory advocates combining learning with social service, enabling students to apply knowledge to solve problems during service, deepening their understanding of knowledge while enhancing social responsibility and overall competency. Higher vocational nursing students participating in community care and elderly services can apply theoretical knowledge in practice, improving their professional skills and service awareness.

3. ANALYSIS OF THE CURRENT STATE OF SOCIAL SERVICES IN HIGHER VOCATIONAL NURSING PROGRAMS IN COMMON PROSPERITY DEMONSTRATION ZONES

3.1 Current Status of Social Services

Using Jinhua Vocational and Technical College as an example, its nursing program collaborates with multiple hospitals to implement order-based training, optimizing curriculum design and increasing the proportion of practical teaching to over 60%. The program annually produces a large number of high-quality nursing talents, achieving a stable initial employment rate of above 98%, with most graduates finding employment locally, thereby strengthening the regional nursing workforce.

In terms of nursing training services, Quzhou Vocational and Technical College has established a "Quzhou Maternal Care" training brand, creating a comprehensive training system that focuses on practice, with practical hours accounting for 70%. To date, over 20,000 trainees have completed the program, with "gold medal" maternal caregivers earning an average monthly salary of 15,000-18,000 RMB, some exceeding 20,000 RMB, thus enhancing maternal and infant care services while promoting employment and income for rural women. Additionally, several institutions have initiated continuing education programs for in-service nursing personnel.

In health promotion and disease prevention, faculty and students from Ningbo Health Vocational and Technical College regularly engage with communities, conducting health lectures and check-ups over 50 times annually, benefiting over 10,000 residents while also collaborating with schools and enterprises on campus health promotion and occupational health protection services.

3.2 Analysis of Social Service Effectiveness

The training outcomes are notable, with nursing graduates from Hangzhou Medical College achieving a nurse qualification examination pass rate exceeding 95% for several consecutive years, demonstrating strong practical abilities and high professional standards, with many becoming key personnel in their fields. Participation in social services has enhanced students' overall quality.

Social services yield positive effects, as nursing training boosts employment and income, while health promotion services raise public health awareness and reduce disease incidence. Furthermore, the trained talents contribute to the development of the healthcare sector, and training programs generate economic benefits for the institutions,

reinvesting in educational quality. Additionally, the social impact of these institutions increases, attracting more students and garnering more community resources.

4. ISSUES AND CAUSES OF SOCIAL SERVICE CAPABILITY IN VOCATIONAL NURSING EDUCATION

4.1 Existing Issues

There is a significant mismatch between the supply and demand for social services. The demand for elderly care and rehabilitation services is high, yet many vocational colleges lag in curriculum development, resulting in a narrow knowledge base among graduates. For instance, the elderly care curriculum lacks interdisciplinary integration, failing to address actual needs. Additionally, service provision does not adequately consider regional differences; rural areas require basic nursing and health education, while vocational programs often focus on urban settings with high-end service content that does not align with real demands.

The depth of industry-education integration is insufficient, with collaborations often limited to internships and guest lecturers. This results in a lack of coordinated training and service mechanisms. Minimal enterprise involvement in curriculum development leads to a disconnect between educational content and job requirements; furthermore, communication and collaboration among stakeholders in social service projects are inadequate, hindering resource integration and service effectiveness.

The curriculum system is irrational, with a disconnect between theory and practice. Theoretical education prioritizes knowledge acquisition over practical skills development, while practical training lacks systematic organization and relevance to clinical settings. Course content updates are slow, failing to keep pace with advancements in nursing techniques and concepts.

4.2 Causes of the Issues

At the policy level, although there are supportive policies for vocational education and industry-education integration, implementation guidelines and complementary measures are lacking. Ambiguities in incentives for enterprise participation result in low engagement levels. Furthermore, there is insufficient guidance and regulation regarding the social service role of vocational nursing programs.

From a mechanism standpoint, there is a lack of effective communication and coordination among schools, hospitals, and enterprises, with unclear rights and responsibilities regarding talent cultivation and social service. The internal management mechanisms for social service within schools are inadequate, lacking unified planning and coordination, leading to scattered service projects and resource waste.

On the resource side, the practical capabilities of faculty in vocational colleges are often lacking. Some instructors do not have clinical experience, making it difficult to guide students effectively. The slow updating of teaching facilities fails to meet the demands of new nursing techniques, and limited financial investment restricts the development and expansion of social service projects.

5. PATHWAYS TO ENHANCE SOCIAL SERVICE CAPABILITY IN VOCATIONAL NURSING WITHIN DEMONSTRATION ZONES FOR COMMON PROSPERITY

5.1 Strengthening Policy Guidance

The government should improve the policy framework supporting social services in vocational nursing, issuing specific implementation guidelines, and clarifying tax incentives and financial subsidies for enterprise involvement. Special policies guiding vocational nursing social services should be developed, encouraging schools to align their service projects with regional health needs, and rewarding institutions with significant service outcomes. A cross-departmental coordination mechanism should be established to enhance collaboration among educational, health, and civil affairs departments, thereby integrating resources and providing policy support.

5.2 Deepening Industry-Education Integration

A close-knit community for industry-education integration should be established, enhancing collaboration among schools, hospitals, and enterprises. In talent cultivation, enterprises should participate in curriculum development and teaching design,

incorporating job demands into educational content. Collaborative talent development plans should be created, and a coordinated service mechanism should be established, integrating resources to jointly undertake community nursing and elderly care projects.

5.3 Optimizing the Curriculum System

The vocational nursing curriculum should be restructured with a focus on social demand. The integration of theory and practice should be strengthened, increasing the proportion of practical courses throughout the training process. New courses in emerging nursing fields such as smart nursing and geriatric rehabilitation should be developed, with timely updates to curriculum content that reflect advancements in nursing technology and concepts. A joint curriculum development mechanism with enterprises should be established, allowing frontline nursing staff to contribute to course design and teaching to ensure alignment with job market needs.

5.4 Enhancing Faculty Development

A "dual-qualified" teaching workforce should be cultivated, encouraging faculty to gain practical experience in hospitals and enterprises to enhance their teaching capabilities. Recruitment of nursing experts and skilled technical personnel as part-time instructors should be prioritized to strengthen the teaching staff. A sustainable teacher training mechanism should be established, providing regular opportunities for faculty to engage in training on new nursing technologies and academic exchanges, thus updating their knowledge base. Faculty evaluation mechanisms should incorporate social service outcomes as part of performance assessments to encourage active participation in social service initiatives.

5.5 Improving Evaluation Mechanisms

A diversified evaluation system should be established to comprehensively assess the social service capabilities of vocational nursing programs. Evaluation stakeholders should include schools, service recipients, partner enterprises, and government departments, with focus areas such as service quality, effectiveness, and social impact. A dynamic monitoring mechanism utilizing big data and information technology should be implemented to track and assess the social service processes and outcomes in real-time, allowing for prompt identification and resolution of issues. Based on evaluation results, outstanding service projects and individuals should be recognized, while suggestions for improvement should be proposed for projects facing challenges, thus continuously enhancing service quality.

6. CONCLUSION AND FUTURE DIRECTIONS

6.1 Research Conclusions

This study thoroughly analyzes the current status, issues, and causes of social service capabilities in vocational nursing within the context of building demonstration zones for common prosperity. It identifies challenges such as supply-demand mismatches, insufficient industry-education integration, and an irrational curriculum system, with root causes spanning policy, mechanisms, and resources. Strengthening policy guidance and deepening industry-education integration are effective measures to enhance social service capabilities in vocational nursing, promoting the coordinated development of nursing education and social services, and contributing to the establishment of common prosperity demonstration zones.

6.2 Future Research Directions

Future research could expand to compare social service capabilities of nursing programs across different regions and types of vocational colleges, identifying strengths and weaknesses. Methodologically, empirical research should be strengthened through surveys and case studies to gain deeper insights into the implementation effects and challenges of pathways to enhance social service capabilities. Attention should also be given to emerging trends in the nursing field, such as the application of artificial intelligence, with timely adjustments made to enhancement strategies for social service capabilities in vocational nursing to provide robust support for the development of nursing services and the achievement of common prosperity goals.

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Comparative Strategies of Glass Ceramics Art Design in Facilitating Intangible Cultural Heritage Transmission: A Focus on Localization Practices

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Abstract: This study focuses on the dynamic transmission of intangible cultural heritage (ICH) by systematically comparing domestic and international strategies in glass ceramics art design and exploring localized practices. Through bibliometric analysis and cross-cultural comparative research, we review literature from the past decade in core international databases concerning glass ceramics art design's role in ICH transmission across three dimensions: cultural value exploration, innovative design pathways, and dissemination model construction. the analysis highlights international experiences in digital innovation, cross-disciplinary design, and community engagement mechanisms while summarizing typical domestic strategies that revitalize traditional craftsmanship, reinterpret cultural symbols, and cultivate industrial ecosystems. Findings reveal that international approaches prioritize technological empowerment and standardized production, whereas domestic strategies emphasize cultural preservation and local development. Based on this, we propose localized practice strategies: constructing a design logic of "traditional gene decoding-digital technology reconstruction-modern aesthetic transformation, " establishing a collaborative innovation ecosystem among government, universities, and enterprises, and exploring a composite dissemination model of "ICH+cultural creativity+cultural tourism" to provide theoretical references and practical guidance for the transmission of ICH in the glass ceramics art design field.

Keywords: Glass ceramics art design; Intangible cultural heritage transmission; International comparison; Localization practices; Innovative design strategies

1. INTRODUCTION

1.1 Research Background and Significance

In the context of accelerated globalization and modernization, intangible cultural heritage (ICH) faces challenges such as reduced viability and fragmented transmission. Glass ceramics art, embodying both material form and cultural significance, carries historical memories and aesthetic genes of diverse regions, gaining international recognition for its ICH status under the "Convention for the Safeguarding of the Intangible Cultural Heritage. " UNESCO reports over 200 ceramic-related techniques listed as ICH worldwide, including 12 Chinese ceramic techniques recognized at the national level.

The incorporation of modern design concepts and technological methods opens new paths for ICH transmission in glass ceramics. For instance, Italy’s Murano glass achieves an annual production value exceeding 1.5 billion euros through design innovation, while Japan's Kutani ceramics attract over 3 million tourists annually due to cultural tourism integration. These cases demonstrate the significant empowering role of art design in the dynamic transmission of ICH. However, China's glass ceramics ICH industry still grapples with severe product homogeneity and market conversion rates below 30%, necessitating research into localized innovative strategies through international comparative studies. This research aims to construct a theoretical framework for integrating glass ceramics ICH transmission

with modern design to guide cultural heritage protection and industrial upgrading.

1.2 Review of Domestic and International Research Status

International research on glass ceramics ICH primarily focuses on cultural value exploration and technological innovation. UK scholar Smith (2018) proposed the "cultural capital transformation theory, " emphasizing modern transformation of ICH values through design language reconstruction. US scholar Brown (2020) established a virtual heritage transmission system for ceramics based on digital twin technology. These studies prioritize technical application and market conversion but lack comprehensive attention to cultural ecological integrity.

Domestic research exhibits multidimensional characteristics: Wang et al. (2021) analyze modern translation methods of ceramic patterns from a cultural semiotics perspective; Li et al. (2022) propose a tripartite transmission model of "craftsmanship-community-market" based on field studies. Existing works are often limited to specific regions or techniques, lacking systematic international comparison, and practical research on localization is still insufficient.

1.3 Research Content and Methodology

This study targets glass ceramics art, employing bibliometric and cross-cultural comparative methods to deconstruct domestic and international strategies for dynamic ICH transmission. Utilizing grounded theory, we conduct coding analysis on 128 core documents and case studies of 15 international and 23 domestic practices. the research comprises three sections: theoretical foundation construction, strategy comparison, and localization pathway design, employing a combination of quantitative and qualitative methods to ensure the scientific rigor and universality of conclusions.

2. THEORETICAL FOUNDATION OF GLASS CERAMICS ART AND DYNAMIC ICH TRANSMISSION

2.1 Cultural Connotations and ICH Characteristics of Glass Ceramics Art

Glass ceramics art integrates material craftsmanship, decorative aesthetics, and cultural symbolism. Traditional Chinese glass follows a craftsmanship philosophy of "seeking wealth through fire, " with its "ancient wax casting" technique involving over 30 procedural steps, reflecting a wisdom of harmony between humanity and nature. European Venetian glass, anchored at the cultural landmark of "Murano, " interlinks "lampworking" techniques with Baroque art styles. This duality of material and spiritual attributes renders it a vital focus for ICH protection. Within UNESCO's ICH classification, glass ceramics techniques fall under the intersection of "traditional craftsmanship" and "social practices, rituals, and festive activities, " highlighting their multidimensional cultural legacy.

2.2 Core Theories and Practical Principles of Dynamic ICH Transmission

Dynamic ICH transmission emphasizes the continuity of cultural genes amidst evolving contexts. UNESCO's three principles of "community participation, sustainability, and innovation-driven" form the theoretical foundation for modern transmission. Domestic scholars propose a "dynamic transmission three-dimensional model, " advocating ecological protection of craftsmanship, creative transformation of cultural values, and innovative development of industrial forms to ensure ICH's survival. Practical cases such as Japan's "Living National Treasure" recognition system and South Korea's ICH education system provide institutional references for dynamic transmission. Together, these theories and practices address the core question: how to organically integrate glass ceramics ICH with modern society while preserving cultural authenticity.

3. STRATEGIES FOR INTERNATIONAL GLASS CERAMICS ART DESIGN TO FACILITATE DYNAMIC ICH TRANSMISSION

3.1 Cultural Value Exploration and Modern Translation Strategies

European glass ceramics design emphasizes cultural narrative reconstruction. the French "Sèvres" porcelain workshop transforms Rococo art elements into modern minimalist patterns, rejuvenating traditional court art for younger markets; Italy’s "Achille Castiglioni Foundation" digitizes archives to extract geometric aesthetics from Venetian glass

craftsmanship, developing a series of modern home products. These practices achieve contemporary translations of traditional values through cultural symbol deconstruction and reconstruction.

3.2 Innovative Design Pathways and Technology Application Strategies

Digital technology serves as a core driver for international ICH innovation. Germany's "Berlin Ceramics Laboratory" employs 3D printing technology for precise replication of complex forms, enhancing production efficiency by 40%; the Corning Museum of Glass in the US develops an AR interactive system that allows users to virtually experience the glass-blowing process. Additionally, innovations in biocompatible materials and intelligent temperature-controlled kilns are driving the green and smart transformation of glass ceramics craftsmanship.

3.3 Dissemination Model Construction and Industrial Development Strategies

Internationally, diverse dissemination matrices are established. the Victoria and Albert Museum in the UK hosts the "Global Ceramics Biennale, " annually attracting over 500, 000 visitors; Japan's Shiga pottery region utilizes "origin traceability" short video marketing, achieving a 25% increase in product premium rates. At the industrial level, France's Hermès collaborates with ceramics workshops to launch limited series, realizing the value synergy of high-end design and traditional craftsmanship; Denmark's Royal Copenhagen expands product lines into home and fashion sectors through brand licensing, surpassing 200 million euros in annual production value.

4. DOMESTIC STRATEGIES FOR GLASS CERAMICS ART DESIGN TO FACILITATE DYNAMIC ICH TRANSMISSION

4.1 Traditional Craftsmanship Protection and Revitalization Strategies

China has established a "database of ICH inheritors, " digitizing records for 1, 276 glass ceramics inheritors. Jingdezhen Ceramic University offers graduate courses in "traditional wood-fired kiln firing, " employing a dual-track teaching model of "master-apprentice+academic. " Zibo's glass region implements a "craft workshop sharing plan, " standardizing processes to enhance the efficiency of Boshan glass production by 30%. These measures enable systematic protection and innovative transformation of traditional craftsmanship.

4.2 Cultural Symbol Extraction and Modern Design Integration Strategies

Domestic design practices focus on decoding regional culture. Fujian Delicate White Porcelain transforms the "He Chaozong" porcelain sculpture style into a modern IP image, surpassing 80 million yuan in derivative sales; Longquan celadon's "ice crackle" element, through parametric design, is applied to the G20 summit dining ware in Hangzhou, aligning traditional culture with international aesthetics. the Palace Museum's cultural products, like the "Thousand Li of Rivers and Mountains" glass bookmark, achieve a 45% product repurchase rate through cultural symbol translation.

4.3 ICH Industrial Ecosystem Cultivation and Sustainable Development Strategies

China has formed composite business models such as "ICH+characteristic towns" and "ICH+live e-commerce. " the Yixing Zisha characteristic town generates over 12 billion yuan in annual output value, creating 32, 000 jobs; Douyin's "ceramics ICH sales" events achieve single transaction volumes exceeding 230 million yuan. Policymaking initiatives, such as the "China Traditional Craft Revitalization Plan, " allocate special funds to support over 300 glass ceramics ICH projects for industrial development, fostering a complete industrial chain.

5. COMPARATIVE ANALYSIS OF STRATEGIES FOR PROMOTING INTANGIBLE CULTURAL HERITAGE THROUGH GLASS CERAMICS ART DESIGN

5.1 Core Strategy Differences

International strategies are market-oriented, emphasizing technological innovation and brand development, while domestic approaches stress cultural preservation, focusing on policy incentives and community engagement. In design philosophy, the West favors abstract symbolism, whereas China prefers concrete elements. Industry models differ as well, with international practices

relying on brand licensing and cross-industry collaboration, while domestic strategies focus on regional clusters and e-commerce marketing.

5.2 Similarities and Differences in Practical Paths

Both domestic and international practices prioritize digital technology, but their application depth varies: abroad, a complete digital chain from production to dissemination has been achieved, while domestically, applications primarily focus on exhibition. In talent development, international systems tightly integrate industry, academia, research, and application, while domestic education often disconnects from industry needs. However, both sides show convergence in cultural tourism integration and IP development.

5.3 Comparative Study of Influencing Factors

In terms of institutional environment, international intangible cultural heritage protection is supported by legal frameworks, while China relies on policy documents. the mature art market in the West provides premium opportunities for intangible heritage products, while the domestic mass consumer market is still developing. Cultural context differences lead to divergent design value orientations: the West pursues universal aesthetics, while China emphasizes cultural identity.

6. LOCALIZED PRACTICAL PATHS FOR GLASS CERAMICS ART DESIGN IN INTANGIBLE CULTURAL HERITAGE TRANSMISSION

6.1 Design Logic Reconstruction and Innovative Methods

Develop a design model based on "cultural gene decoding-digital technology reconstruction-modern aesthetic transformation. " Establish a database of glass ceramic patterns, utilizing deep learning to extract cultural features; implement digital twin technology for visual heritage transmission; and create contemporary culturally creative products based on user profile analysis. For instance, the Zibo glass "layered carving" technique could be transformed into 3D modeling parameters for a personalized customization system.

6.2 Collaborative Innovation Ecosystem Construction

Establish a collaborative mechanism among government, universities, enterprises, and communities. the government should enhance intangible heritage intellectual property protection laws and set up dedicated innovation funds; universities should offer interdisciplinary courses on "intangible heritage design innovation"; enterprises should create "intangible heritage+design studios" with industrial design teams; and communities should organize skill experience activities to nurture local consumer markets. the Jingdezhen "Taoxichuan" cultural and creative park exemplifies this approach, achieving an annual output value exceeding 5 billion yuan through resource integration.

6.3 Composite Communication and Industry Development Models

Create a fusion communication matrix of "online+offline. " Develop AR interactive applications for intangible heritage and host immersive digital exhibitions; establish cultural theme parks focused on glass ceramics and conduct educational tourism. On the industry front, promote the "intangible heritage+rural revitalization" strategy by developing specialty handicraft industries in traditional production areas; establish an intangible heritage brand certification system to enhance product market competitiveness. For example, Yunnan Jianshui purple pottery utilizes the "intangible heritage workshop+live broadcast base" model, increasing local villagers' average annual income by 28, 000 yuan.

7. CONCLUSION

This study systematically compares domestic and international strategies for promoting intangible cultural heritage through glass ceramics art design, revealing the influence mechanisms of cultural context, institutional environment, and market structure on transmission pathways. the findings indicate that localized practices should build a composite model of "technology empowerment, design innovation, and ecological collaboration" while maintaining cultural authenticity. Future research could further explore the ethical boundaries of artificial intelligence in intangible heritage

design and the unique value of local culture amid global cultural convergence.

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The Impact of National Policies on the Construction of Library Resources in Local Universities

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Abstract: This study systematically investigates the mechanisms and effects of national policies on the construction of library resources in local universities. Utilizing a combination of policy text quantitative analysis, bibliometric analysis, and normative research, we establish a framework for policy text analysis. We systematically review national policies related to library resource construction from dimensions such as policy objectives, resource allocation mechanisms, and service efficiency enhancement. By employing knowledge graph visualization techniques, we analyze the evolution of policies and shifts in research hotspots. The findings indicate that national policies significantly promote the development of library resource construction in local universities through strategic planning, funding support, and the establishment of standards, particularly in areas such as digital resource transformation, precise disciplinary services, and the development of open sharing systems. However, challenges such as insufficient regional collaboration and variability in policy implementation arise during execution. The study concludes that enhancing the dynamic adjustment mechanisms of policies and strengthening the combination of policy tools, along with developing a tripartite responsive system among the "national-regional-university" levels, are key pathways to improving the quality of library resource construction in local universities. This research provides theoretical foundations and decision-making references for optimizing the policy environment of university libraries and promoting high-quality resource development.

Keywords: National policy; Local universities; Library resource construction; Policy impact; Resource development optimization

1. INTRODUCTION

1.1 Research Background and Significance

In the context of the deep integration of the knowledge economy and digital transformation, higher education serves as a core domain for knowledge dissemination and innovation, directly impacting talent cultivation and research capabilities. Local universities, as vital components of China's higher education system, play a crucial role in regional talent supply, knowledge services, and cultural heritage. The level of library resource development in these institutions not only affects their own growth but also exerts a ripple effect on the regional educational ecosystem and cultural development. National policies, as key guiding forces for resource allocation and development direction, play a strategic regulatory role in the library resource development of local universities. Continuous policy initiatives, from the "Double First-Class" construction to the digital education strategy, aim to optimize library resources and upgrade services, significantly impacting local universities' library resource development.

Researching the influence of national policies on local universities' library resource development holds significant theoretical and practical value. Theoretically, analyzing the interaction between policies and library resource development can expand the boundaries of educational policy studies and library science, providing empirical evidence to enhance related theoretical frameworks. Practically, systematically reviewing the effectiveness and issues of policy implementation can optimize policy design and execution paths, promoting high-quality development in local universities' library

resources, thereby enhancing the overall effectiveness of higher education in serving society.

1.2 Review of Domestic and International Research Status

Internationally, research on the impact of policies on university library development began early, focusing on the effects of policies on resource integration, technology application, and service model transformation. The U.S. Higher Education Act promotes the digital transformation and cross-regional sharing of university libraries through fiscal support and standard-setting; the EU Horizon Program integrates open science policy into library services, facilitating open access and collaborative innovation. These studies are based on mature policy environments and market-oriented operational models, emphasizing the precision of policy tools and the efficiency of resource allocation.

In China, research has focused on the role of national policies in university library development, encompassing dimensions such as policy text analysis, resource development paths, and service innovation strategies. Some scholars have quantitatively analyzed policy texts, revealing a year-on-year increase in national support for the digital development of university libraries. Other studies have highlighted regional disparities in policy implementation, noting delays in economically underdeveloped areas. However, existing research often emphasizes single policies or specific areas, lacking in-depth exploration of the systematic relationship between policy frameworks and library resource development. Moreover, there is a theoretical gap in the dynamic assessment mechanisms and optimization pathways of policy impacts, necessitating the construction of a more explanatory analytical framework from multidisciplinary perspectives.

2. THEORETICAL FOUNDATION AND RESEARCH METHODOLOGY

2.1 Core Concept Definitions

Local university library resource development refers to the activities undertaken by universities to collect, organize, store, and construct service systems for books, journals, electronic resources, and other documentation in response to teaching, research, and social service needs. This includes optimizing physical resource distribution, building digital resource platforms, and enhancing subject service capabilities. National policies are institutional documents formulated by the central government and relevant departments, aimed at guiding higher education development, standardizing resource allocation, and enhancing educational service effectiveness. Their impact on local university library resource development manifests through policy objectives, resource allocation mechanisms, and service efficiency requirements, influencing aspects such as resource structure, technology application, and service models.

2.2 Theoretical Basis

This research is supported by policy tool theory, resource dependency theory, and knowledge service theory. Policy tool theory views policy implementation as the process of utilizing different combinations of tools, revealing the intervention methods and intensity of policies on library resource development. Resource dependency theory emphasizes organizations' reliance on external resources, highlighting the significant influence of national policy resource allocation on local university library resource development in funding, technology, and talent. Knowledge service theory focuses on the transformation of libraries from document resource providers to knowledge value-added service centers, where national policies guide service model innovation through standards and norms. The integration of these theories provides a theoretical framework for analyzing the interaction between policies and library resource development.

2.3 Research Methodology

The study employs a mixed-method approach. Policy text analysis utilizes NVivo software to code and extract themes from 38 relevant policy documents issued by the Ministry of Education, Ministry of Finance, and other departments from 2010 to 2023, identifying policy tool types and implementation focuses. Bibliometric analysis employs the CNKI and Web of Science databases to conduct keyword co-occurrence analysis of core journal articles, mapping knowledge evolution. Normative research, supported by field survey data, conducts qualitative analysis of the current

state of library resource development in local universities. This combined approach ensures multidimensional validation of policy texts, academic research, and practical realities, enhancing the scientific rigor and universality of the conclusions.

3. ANALYSIS OF THE IMPACT MECHANISMS OF NATIONAL POLICIES ON LOCAL UNIVERSITY LIBRARY RESOURCE DEVELOPMENT

3.1 Impact of Policy Objective Orientation

National policies clarify the development direction of local university library resource development through strategic planning. Under the "Education Digitalization 2.0 Action Plan," local universities are accelerating digital resource development, with annual growth rates of 15% in electronic book acquisitions and over 60% of universities establishing subject knowledge graph platforms. Policies promoting "New Liberal Arts" and "New Engineering" guide libraries to optimize resource structures, with literature resources in humanities and social sciences and emerging technologies increasing by 8% and 12%, respectively. Additionally, policy objectives are transmitted through evaluation indicators, with the Ministry of Education incorporating library resource guarantee rates as core assessment criteria, prompting local universities to increase resource development investments. This objective-oriented mechanism fosters deep alignment between library resource development and national strategic needs, achieving dynamic optimization of resource distribution.

3.2 Impact of Resource Allocation Mechanisms

Fiscal support and project-driven approaches constitute the core paths of national policy resource allocation. The central government has invested 28 billion yuan through the "Central and Western Universities Comprehensive Strength Enhancement Project," with 18% allocated to library infrastructure renovation and resource acquisition. Special policies like the "Digital Resource Co-construction and Sharing Plan for University Libraries" employ incentive-based funding, leveraging local universities' matching funds exceeding 4 billion yuan to establish 23 regional digital resource alliances. Resource allocation mechanisms also impact human resources, with the "University Library Professional and Technical Talent Training Program" increasing the proportion of librarians with master's degrees or higher from 32% in 2015 to 47% in 2023. This multidimensional resource injection significantly improves the material foundation and talent pool for local university library resource development.

3.3 Impact of Service Efficiency Enhancement Requirements

National policies drive the transformation of local university library service models through service standardization and innovation incentives. The "Regulations on University Libraries" clearly require libraries to engage in subject-based services, leading 78% of local universities to establish subject librarian positions, resulting in an average of over 12,000 subject service projects annually. Open access policies promote the construction of institutional repositories, with local universities' repositories seeing an annual growth of 22% in document inclusions, of which open access papers account for 35%. Policies also encourage libraries to participate in community service, with 42 local university libraries in the Yangtze River Delta opening digital resources to the public, serving over 800,000 visitors annually. These service efficiency enhancement requirements urge libraries to transition from document collection centers to knowledge service hubs, strengthening their societal outreach.

4. CURRENT ANALYSIS OF THE INFLUENCE OF NATIONAL POLICIES ON LOCAL UNIVERSITY LIBRARY RESOURCE DEVELOPMENT

4.1 Current Status of Resource Digitalization Transformation

National policies have significantly advanced the digitalization of local university library resources. The total digital resources in local universities have exceeded 8,500 TB, marking a 210% increase since 2018, with an annual increase of 12% in electronic journal subscriptions. The widespread adoption of supercomputing and cloud computing has enabled 83% of universities to implement distributed storage and cross-campus access to

digital resources. However, regional disparities are evident, with Eastern region universities investing 2.3 times more in digital resource development than those in the Western region, and resource update frequencies being 40% faster. Some universities exhibit a "heavy procurement, light integration" phenomenon, with a resource integration rate of less than 55%, impacting resource utilization efficiency.

4.2 Current Status of Precision in Subject Services

Precision in subject services has become a crucial development direction under policy guidance. Local universities commonly establish a "subject librarian-teacher-student" collaborative service model, with 92% of universities creating subject resource navigation systems, achieving 76% coverage of specialized databases for key disciplines. However, disparities exist in service depth and breadth, with satisfaction rates for subject services reaching 89% in "Double First-Class" universities, compared to only 68% in regular local universities. Shortcomings in service capabilities are evident, particularly in data mining and knowledge discovery technology applications, with only 31% of universities providing subject trend analysis services, insufficient to meet the interdisciplinary development needs.

4.3 Current Status of Open Sharing System Construction

Driven by policies, a preliminary open sharing system for local university library resources has emerged. A total of 47 provincial university library alliances have been established nationwide, achieving full coverage of interlibrary loan services, with over 12 million documents exchanged annually. The construction of open access platforms is accelerating, with the "Chinese University Science and Technology Journal Open Access Platform" including 580 local university journals, achieving a 73% open access rate. However, sharing mechanisms remain imperfect, with technical barriers to cross-regional resource sharing and a standardization level of data interfaces below 40%. Intellectual property protection and benefit distribution mechanisms are yet to be established, limiting the depth of sharing expansion.

5. ISSUES IN NATIONAL POLICY IMPACTING LOCAL UNIVERSITY LIBRARY RESOURCE DEVELOPMENT

5.1 Insufficient Regional Collaboration

The implementation of national policies varies significantly across regions. Eastern regions leverage policy advantages to form a diversified investment model characterized by "government-led, university collaboration, and enterprise participation," with per capita library funding reaching 2.8 times that of Central and Western regions. The effectiveness of policy execution is constrained by regional economic levels, with Northeast universities facing budget pressures resulting in annual reductions of 5% in digital resource procurement funding, while Eastern regions maintain over 10% growth. The lack of top-level design for inter-regional resource sharing results in less than 25% of universities outside major city clusters like the Beijing-Tianjin-Hebei, Yangtze River Delta, and Guangdong-Hong Kong-Macao Greater Bay Area participating in cross-regional resource co-construction projects, exacerbating regional development disparities.

5.2 Variability in Policy Execution Flexibility

Local universities exhibit significant differences in understanding and executing policies. Surveys indicate that 43% of universities have not fully implemented requirements for the long-term preservation of digital resources, with only 28% establishing comprehensive sustainable preservation mechanisms. The flexibility of policy execution is influenced by the governance capabilities of universities; high-level institutions can achieve policy transformation through institutional innovation, while some local colleges exhibit a "heavy reporting, light implementation" phenomenon, with 15% of special funds allocated to non-core business areas. The adaptability of policy tool selection is inadequate, with incentive tools proving less effective in economically underdeveloped regions than regulatory tools, resulting in varied achievement of policy objectives.

5.3 Other Related Issues

The dynamic adjustment of policies lags behind technological advancements and changing demands. The application of new technologies such as artificial intelligence and

blockchain in library resource development lacks targeted policy guidance, with only 12% of universities establishing intelligent recommendation systems. Policy evaluation systems are not fully developed, with existing indicators focusing on resource quantity and hardware facilities, assigning less than 30% weight to soft indicators like service quality and user experience. Furthermore, there are gaps in aligning policy formulation with actual university needs, with 70% of universities reporting inadequate policy support for the development of discipline-specific resources, hindering differentiated development.

6. RECOMMENDATIONS FOR OPTIMIZING NATIONAL POLICIES TO ENHANCE LIBRARY RESOURCE DEVELOPMENT IN LOCAL UNIVERSITIES

6.1 Improve the Dynamic Policy Adjustment Mechanism

Establish a dynamic mechanism for aligning policies with technology and demand. Form a policy tracking and evaluation team to utilize big data analytics for real-time monitoring of policy implementation. Conduct specialized evaluations biennially to generate adjustment plans. Develop forward-looking policy guidelines for emerging technologies, such as artificial intelligence and the metaverse, to guide universities in the construction of smart libraries. Create a feedback platform for policy needs to gather the actual demands of local universities, transitioning from a "top-down" approach to an "interactive" two-way optimization.

6.2 Strengthen the Use of Policy Tool Combinations

Develop a diversified policy tool system. Increase the proportion of incentive tools, providing tax reductions and special rewards for universities that excel in co-building and sharing digital resources. Optimize the application of informational tools, promoting advanced experiences through policy white papers and case libraries. Implement differentiated policies based on regional characteristics, enhancing fiscal transfers and offering technical training and talent support for central and western regions; focus on innovative pilot policies in eastern regions to encourage exploration of market-oriented resource allocation models.

6.3 Establish a Three-Tiered Collaborative Policy Response System

Create a collaborative mechanism among "National-Regional-University" tiers. At the national level, strengthen top-level policy design by establishing unified standards for resource development and sharing. At the regional level, rely on university alliances to form policy execution coordination bodies for integrated resource allocation and project implementation. At the university level, enhance internal policy conversion mechanisms to incorporate national policy requirements into library development plans. Promote seamless links in policy formulation, execution, and supervision through joint meetings and collaborative evaluation mechanisms, thereby improving overall policy effectiveness.

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Research on the Practice and Innovation of Integrating Matahu Grass Weaving into Kindergarten Art Education

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Abstract: This study focuses on the integration of Matahu grass weaving into kindergarten art education, aiming to explore pathways for combining intangible cultural heritage with preschool art education. Through literature analysis, the artistic connotations and educational values of Matahu grass weaving are identified. A survey of 70 teachers from three kindergartens in Zibo and semi-structured interviews with 10 teachers investigate the current integration status and influencing factors. Based on empirical research, a "Goal-Content-Implementation-Evaluation" integrated strategy is constructed. Findings reveal that the ecological sustainability, aesthetic characteristics, and cultural heritage value of Matahu grass weaving align well with the objectives of kindergarten art education. Current integration practices face challenges such as unclear curriculum goals and fragmented content selection. Strategies such as developing thematic course modules, creating immersive intangible cultural heritage environments, and establishing collaborative mechanisms between families and schools can effectively enhance children's aesthetic perception and cultural identity regarding traditional crafts. This study provides an actionable practical model for incorporating intangible cultural heritage elements into kindergarten curricula, offering both theoretical and practical value for expanding the content system of kindergarten art education and promoting the living transmission of intangible cultural heritage.

Keywords: Matahu grass weaving; Kindergarten art education; Intangible cultural heritage; Curriculum integration; Educational strategies.

1. INTRODUCTION

1.1 Research Background

In the context of national efforts to promote the protection and transmission of intangible cultural heritage, the "14th Five-Year Plan for the Protection of Intangible Cultural Heritage" encourages elementary and secondary schools to offer courses focused on intangible heritage and supports the involvement of inheritors in teaching. Ma Tahu Grass Weaving, a traditional craft unique to the Zibo region of Shandong, aligns with the practical and aesthetic needs of preschool art education. Zibo is actively promoting the "Shandong Handmade" initiative, incorporating Ma Tahu Grass Weaving into local cultural promotion systems. However, practical issues such as unclear integration paths and incomplete curriculum systems remain in integrating intangible heritage into kindergarten education. Concurrently, there is increasing emphasis in early childhood education on utilizing local cultural resources, as outlined in the "Guidelines for Learning and Development of Children Aged 3-6, " which provides a theoretical basis and practical opportunities for incorporating Ma Tahu Grass Weaving into preschool art education.

1.2 Research Objectives and Significance

This study aims to explore the integration of Ma Tahu Grass Weaving into preschool art education by constructing an integrated curriculum system that addresses the current issue of superficial integration of intangible heritage in early childhood education. Specific objectives include analyzing the artistic characteristics and educational value of Ma Tahu Grass Weaving, surveying its current integration status in preschool art education, and developing innovative and practical strategies for curriculum development from the perspective of intangible heritage.

Theoretically, this research expands the traditional framework of preschool art education, which predominantly focuses on modern art by incorporating local intangible heritage elements into the curriculum, enriching the theoretical dimensions of curriculum development and providing academic references for interdisciplinary studies between intangible heritage and preschool education. Practically, the findings can directly support preschool art education practices, enhancing children's aesthetic appreciation and cultural identity concerning traditional crafts. Additionally, it opens new pathways for the living inheritance of Ma Tahu Grass Weaving, contributing to rural cultural revitalization and the sustainable development of intangible heritage protection.

1.3 Review of Domestic and International Research Status

Domestic Research Status: Research on Ma Tahu Grass Weaving has shifted from craft inheritance to diverse applications. Gong Yuxia (2009), a municipal intangible heritage inheritor, has innovatively transformed traditional grass weaving into fashionable handicrafts and promoted the "Grass Weaving in the Classroom" initiative, providing grassroots experience for intangible heritage education. Tian Xiaobin (2023) suggests that grass weaving must consider both practical and artistic values by integrating fashionable elements (e. g., grass-weaved rabbits and bags) to attract younger demographics, thereby providing insights into aesthetic awakening in early childhood education. Liu Jing (2022) views Ma Tahu Grass Weaving as an important medium of "Zibo Memory" from a regional cultural perspective, emphasizing its emotional connection in urban cultural development.

In preschool art education, Lv Yaojian and Sun Kejing (2014) categorize educational objectives into behavioral, exploratory, and expressive types, creating a theoretical framework for curriculum goal design. Lin Lin and Zhu Jiaxiong (2014) argue that content selection should align with children's experiences, while Zou Haiping (2019) further emphasizes the need to match children's interests and artistic experiences, offering methodological guidance for the integration of intangible heritage elements. However, current research has shortcomings: there is insufficient systematic exploration of the educational value of Ma Tahu Grass Weaving and a lack of empirical studies on integration strategies, especially regarding the adaptability of aesthetic psychology in children and intangible heritage crafts.

International Research Status: Dewey's progressive education methodology champions "learning by doing, " emphasizing children's autonomy in artistic activities, aligning with the hands-on practice crucial to intangible heritage education. Victor Lowenfeld's (1993) theory of "self-expression" underscores providing children with space for free exploration, consistent with the creative expression encouraged in Ma Tahu Grass Weaving activities. Burton's (2014) multi-faceted evaluation system (teacher evaluation, self-evaluation, platform evaluation) offers an international perspective for reforming evaluation in preschool art education. Yet, international research lacks focused exploration of Chinese local intangible heritage crafts, necessitating adaptive adjustments within the Chinese cultural context.

2. THEORETICAL FOUNDATIONS OF MA TAHU GRASS WEAVING AND PRESCHOOL ART EDUCATION

2.1 Artistic Connotations and Characteristics of Ma Tahu Grass Weaving

Ma Tahu Grass Weaving is a traditional craft utilizing raw materials like reeds and willow branches, with a history dating back to the Neolithic period around 7000 years ago, and is now listed as an intangible cultural heritage in Zibo. the craft possesses both practical and aesthetic attributes: practically, woven products (e. g., mats, baskets) closely relate to the lives of lakeside residents, reflecting the ecological wisdom of "using local materials efficiently"; aesthetically, the weaving techniques (e. g., flat weaving, twist weaving, coiling) create texture effects, and the color combinations (natural grass colors and dyed techniques) present unique artistic expression. Key characteristics include: Ecological and Environmental Friendliness: Materials derived from natural plant sources are biodegradable and non-polluting, aligning with modern green education principles;

Cultural Symbolism: Weaving patterns (e. g., "Fu Lu Shou") embody auspicious meanings, serving as material carriers of Qilu culture and lakeside folklore;

Craft Innovation: Contemporary inheritors like Han Guangying have introduced new materials, such as colored packaging paper, breaking traditional material constraints and aligning works with modern aesthetic sensibilities.

2.2 Theoretical Foundations of Preschool Art Education

Preschool art education is grounded in child developmental psychology and aesthetic education. In terms of objectives, Bloom's Taxonomy categorizes cognitive, skill, and emotional domains, which in art education manifests as understanding the significance of artistic symbols (cognitive), mastering basic creation techniques (skill), and cultivating aesthetic emotions and cultural identity (emotional). the "Guidelines for Learning and Development of Children Aged 3-6" further emphasize that art education should "be based on our national and folk arts, " providing policy support for the integration of Ma Tahu Grass Weaving into the curriculum.

In content selection and implementation, Lin Lin and Zhu Jiaxiong's (2014) "goal-first, content-later" principle is instructive, advocating for content related to children's life experiences based on educational objectives. the collection of materials and the weaving process of Ma Tahu Grass Weaving are closely tied to children's daily experiences (e. g., nature observation, hands-on activities), aligning with the "experience relevance" principle. Regarding teaching methods, Lv Yaojian and Sun Kejing (2020) oppose "closed demonstrations" and advocate for discussions to stimulate children's initiative, resonating with the "exploration-creation" learning model in weaving activities.

3. RESEARCH METHODOLOGY AND DESIGN

3.1 Research Objects and Scope

This study focuses on three kindergartens in Zibo, Shandong, that conduct educational activities related to Ma Tahu Grass Weaving: Huantai County Qifeng Town Central Kindergarten (located near Ma Tahu and has attempted weaving courses), Zibo Vocational College Affiliated Kindergarten (a public urban kindergarten), and a private inclusive kindergarten. the research subjects include 70 preschool teachers (classroom teachers, art teachers, and curriculum developers) from the three institutions, with 10 randomly selected for in-depth interviews, alongside children from two classes each in small, medium, and large age groups as observation subjects. the study duration spans from May to December 2024, encompassing the complete cycle of curriculum development, implementation, and evaluation.

3.2 Research Methods

Literature Analysis: Systematically reviews domestic and international literature on Ma Tahu Grass Weaving, preschool art education, and the integration of intangible heritage courses, focusing on the practical explorations of scholars like Gong Yuxia (2009) and Tian Xiaobin (2023), as well as theoretical studies by Lin Lin et al. (2014) to construct the research framework.

Questionnaire Survey: Develops a "Survey on the Status of Integrating Ma Tahu Grass Weaving into Preschool Art Education, " covering 30 items such as teachers' awareness of weaving culture, existing curriculum setups, and teaching resource access channels, using a Likert 5-point scale for scoring, distributed and collected both online and offline.

Interview Method: Creates a semi-structured interview outline focused on themes like "challenges in curriculum development, " "child participation feedback, " and "parental attitudes, " conducting in-depth interviews with 10 teachers, each lasting about 45 minutes, with recordings and transcriptions.

Empirical Research: Conducts an 8-week experimental program of Ma Tahu Grass Weaving art education in the three kindergartens, designing activities in three phases: "exploration of weaving materials, " "simple shape weaving, " and "thematic creation, " collecting practical data through classroom observations, artwork analyses, and teacher reflective journals.

3.3 Research Tools and Data Processing

The questionnaire analysis uses SPSS 26.0 for data processing, including descriptive (mean, standard deviation) and inferential statistics (chi-square tests), to analyze the correlation between teacher awareness and course

implementation effectiveness. Interview data is analyzed using NVivo 12 for coding, identifying key influencing factors such as "teacher competency, " "resource support, " and "parental awareness. " In empirical research, children's artworks are quantitatively evaluated using a three-dimensional scale encompassing "creativity, " "technical proficiency, " and "cultural element expression, " supplemented by qualitative analysis of children's activity performance based on teachers' recorded observations (e. g., duration of focus, frequency of questions).

4. ANALYSIS OF THE CURRENT STATUS OF INTEGRATING MATAHU LAKE GRASS WEAVING INTO PRESCHOOL ART EDUCATION

4.1 Survey on the Current Status of Integration

The survey results indicate that out of 70 distributed questionnaires, 65 were effectively collected, yielding an effective response rate of 92.86%. Regarding teachers' awareness, only 23.08% reported having a "systematic understanding of the historical and cultural background of Matahu Lake grass weaving, " while 53.85% were aware of it as a local craft and 23.07% had no knowledge at all. This reflects a significant gap in the teachers' understanding of local intangible cultural heritage (ICH). In terms of curriculum implementation, only Qifeng Town Central Kindergarten offered grass weaving-related activities, with a frequency of 1-2 times per month, mainly focusing on "cognition of weaving materials" and "simple weaving experiences, " lacking a systematic course design.

Interview data further revealed multiple constraints in conducting grass weaving activities in kindergartens: in the staffing aspect, 80% of teachers indicated a "lack of knowledge and teaching methods related to grass weaving"; in terms of resources, 60% of kindergartens reported "no stable source of grass weaving materials, " and there was no established cooperation mechanism with local ICH inheritors; regarding parental awareness, 45% of parents believed that "grass weaving activities have low relevance to child development, " showing a preference for conventional art forms like painting and crafts.

4.2 Analysis of Influencing Factors

Through NVivo coding analysis, three core influencing factors were identified:

Internal Factors: Teachers' cultural literacy and teaching ability concerning ICH are key constraints. the survey showed that only 15.38% of teachers had received training related to ICH, and 69.23% said they "do not know how to adapt grass weaving techniques for preschool activities. "

External Factors: Insufficient policy support and resource integration. Although Zibo City has implemented the "Intangible Heritage in Schools" policy, the support for kindergartens in terms of special funds and teacher training is limited, and there is a lack of a regular cooperation mechanism with Matahu Lake grass weaving workshops and ICH inheritors.

Child Development Adaptability Factors: the precision required in grass weaving conflicts with the developmental motor skills of preschool children. Empirical observations revealed that children under five struggled with tasks like scissors use and weaving, indicating a need for simplified tools and techniques.

4.3 Issues in Integrating Grass Weaving into Preschool Art Education

Based on the survey and analysis, three prominent issues in current integration practices are identified:

Vague Curriculum Objectives: Existing activities focus primarily on skill training (e. g., "learning flat weaving techniques") while neglecting cultural transmission and aesthetic emotion cultivation, deviating from the guidelines that emphasize "experiencing beauty, expressing beauty, and creating beauty. "

Fragmented Content Selection: Activity content lacks a logical progression and fails to form a complete chain of "cognition-experience-creation. " For instance, some kindergartens only conducted "grass weaving basket observations" without extending to cultural interpretation or creative expression.

Lack of Evaluation System: Most teachers use a singular standard of "completion of the work" to evaluate activity effectiveness, overlooking children's emotional experiences and collaborative abilities during activities, thus disconnecting from Burton's multi-faceted evaluation concept.

5. PRACTICAL STRATEGIES FOR INTEGRATING GRASS WEAVING INTO PRESCHOOL ART EDUCATION

5.1 Strategies for Curriculum Objective Formulation

Curriculum objectives should balance ICH cultural transmission with children's developmental needs, forming a three-dimensional objective system. In the cognitive dimension, the goal is to help children perceive the material characteristics, basic weaving skills, and cultural significance of Matahu Lake grass weaving. For example, through a "grass weaving material touch exploration" activity, over 80% of middle-class children should accurately describe the texture differences between reeds and willows. the skills dimension focuses on fine motor development and creative expression, such as having senior class children create basic shapes of "grass weaving animals" with 60% independently adding decorative elements. the emotional and cultural identity dimension emphasizes fostering children's affinity for local ICH, enabling 90% of children to tell at least one story of a grass weaving inheritor through a "hometown grass weaver" themed activity.

Goal formulation should adhere to a "step-by-step development" principle: the young class should focus on sensory experiences, setting foundational goals like "perceiving the natural properties of weaving materials"; the middle class should emphasize skill initiation, such as "learning simple cross-weaving techniques"; and the senior class should highlight cultural understanding and creative expression, like "using grass weaving elements to create hometown scenery. " This objective system not only aligns with the core requirements of the "Guidelines for Learning and Development of Children Aged 3-6" in the "Art Domain" but also emphasizes the intangible heritage characteristics of Matahu Lake grass weaving.

5.2 Strategies for Content Selection and Organization

Developing course content requires establishing a logical chain of "cultural gene extraction-children's experience transformation-activity sequence design. " First, extract three core elements from Matahu Lake grass weaving: ecological elements (material collection, environmental attributes), artistic elements (weaving patterns, color coordination), and folk elements (auspicious patterns, practical applications). Tailor these elements into actionable activity content based on the development characteristics of different age groups: the young class can design a "grass weaving material treasure hunt" game to build tactile understanding of reeds and bulrushes through touching and classification activities; the middle class can undertake "grass weaving bookmarks" production to learn basic flat weaving techniques; and the senior class can implement a "Matahu Lake grass weaving story creation" project, combining weaving patterns with folklore, such as using "fish pattern" designs to narrate fishing customs in the lake area.

Content organization should adopt a "thematic unit" model, with each unit encompassing four modules: "cultural cognition-skill experience-creative expression-life extension. " For example, a "grass weaving and seasons" themed unit could introduce the labor wisdom of local ancestors in "summer weaving mats and winter weaving baskets" during the cultural cognition phase; guide children in using dyed grass strips to create "seasonal wreaths" in the skill experience phase; encourage children to decorate the classroom "seasonal tree" with grass weaving elements during the creative expression phase; and assign a "finding grass weaving items at home" parent-child task in the life extension phase. This content structure ensures the integrity of ICH while adhering to children's "learning by doing" cognitive patterns.

5.3 Strategies for Implementing Teaching Activities

The implementation of teaching should establish an activity model of "immersive situations-layered guidance-multiple interactions. " In terms of situational creation, kindergartens can build a "Matahu Lake grass weaving workshop" by hanging grass weaving fishing tools, setting up weaving process flowcharts, and playing local folk songs to create an immersive ICH environment. Teaching methods should employ a "gamified exploration" strategy, such as designing the learning of flat weaving techniques as a "grass weaving pathway challenge" game, where

children learn to weave grass strips on a grid board to naturally grasp the basic principles of weaving.

To address individual differences among children, a "three-layer guidance" strategy should be implemented: providing "tool improvement" support for children with weaker skills (e. g., using blunt-tipped weaving needles and pre-cut grass strips); setting "task cards" for children at intermediate levels to guide them (e. g., step-by-step illustrations for making "grass weaving coasters"); and offering "creative expansion" challenges for more capable children (e. g., trying mixed material weaving). Moreover, a "resident ICH inheritor" mechanism should be introduced, inviting local inheritors like Gong Yuxia to conduct a "master workshop" monthly, providing live demonstrations and interactive Q&A sessions to let children directly experience the charm of traditional crafts.

5.4 Strategies for Evaluating Teaching Activities

Construct a diversified evaluation system comprising "three dimensions and six indicators. " In the child development dimension, set three indicators: "aesthetic perception" (e. g., accuracy in describing grass weaving patterns), "skill mastery" (e. g., coordination in weaving actions), and "cultural expression" (e. g., incorporation of folk elements in works), evaluated through "work analysis+observation records. " the teacher development dimension includes "ICH knowledge reserves, " "activity design innovation, " and "guidance strategy effectiveness, " assessed through peer evaluations, lesson plan analyses, and teaching reflection logs. the course implementation dimension should focus on "resource integration" and "parent satisfaction, " collecting data through questionnaire surveys (parent version) and community cooperation case analyses.

The evaluation tools should emphasize child-friendly and visual aspects, such as designing a "grass weaving little expert" growth manual for children to record their performance at each stage using cartoon stickers, and developing a "ICH teaching ability radar chart" for teachers to quantitatively assess knowledge, skills, and innovation dimensions. An empirical study found that a pilot kindergarten utilizing this evaluation system saw a 37% increase in children's recognition of grass weaving culture and a 29% rise in teachers' confidence in ICH teaching.

5.5 Strategies for Family and Community Collaboration in ICH Transmission

Establish a collaborative mechanism involving "kindergarten-family-community" integration. At the family level, design a "grass weaving parent-child task package" containing simple weaving materials, a parent guidance manual, and an activity plan for a "grass weaving family storytelling session. " In a "grass weaving parent-child creative competition" conducted by a kindergarten, 85% of families submitted grass weaving works that integrated modern elements (e. g., grass weaving robots, grass weaving table lamps), enhancing parent-child interaction and stimulating the innovative vitality of traditional crafts.

At the community cooperation level, build an "ICH education base for children" in collaboration with Matahu Lake grass weaving workshops, organizing visits to grass weaving raw material plantations and participating in seasonal harvesting activities to form a complete cycle of "cognition-experience-transmission. " Additionally, invite grass weaving artists to host "ICH open days" in the community to educate parents about the value of grass weaving education, aiming to change the perception that "45% of parents believe grass weaving activities have low relevance to child development. " Supported by the Zibo City's "Shandong Handcrafted" project policy, this collaborative model has become a normalized operational mechanism in three pilot kindergartens.

6. INNOVATIONS AND APPLICATIONS

6.1 Degree of Innovation

Innovative Course Development Model: This study breaks through the traditional solitary model of ICH education focused on "skill transmission, " constructing a progressive course framework of "cultural cognition-aesthetic experience-creative expression, " transforming the ecological, artistic, and folk values of Matahu Lake grass weaving into activity sequences that align with children's cognitive characteristics. This model differs

from previous research that favored "skills over culture, " achieving a deep integration of ICH elements with preschool education objectives.

Innovative ICH Transmission System: This study lowers the transmission starting point to the preschool education stage, establishing a "seedling cultivation" mechanism for ICH cultural transmission through paths of "gamified enlightenment-lifestyle penetration-social extension. " Compared with Tian Xiaobin's approach of "instilling cultural confidence in young people's hearts, " this research innovatively constructs a continuous transmission chain from preschoolers to adolescents, filling the gap in systematic research on ICH education at the preschool stage.

6.2 Application Value

Theoretical Value: This research enriches the content system of preschool art education, providing a theoretical model for the intersection of ICH culture and preschool curricula. the proposed theoretical outcomes such as "three-dimensional objective system" and "thematic unit structure" can be expanded to studies of other ICH projects like paper-cutting and pottery in early childhood education, offering methodological references.

Practical Value: This study provides kindergartens with actionable ICH curriculum plans, including objective formulation templates, activity design cases, and evaluation toolkits. A provincial-level model kindergarten that applied this plan developed the "Matahu Lake Grass Weaving Preschool Art Activity Guidelines, " which has been promoted by the Zibo Education Bureau to 20 kindergartens, effectively advancing the dynamic transmission of local ICH. Additionally, the research outcomes provide innovative ideas for ICH inheritors in preschool education, such as Han Guangying, who developed a "soft grass weaving material kit" based on children's hand development characteristics, achieving a dual empowerment of craftsmanship and education.

7. CONCLUSION

This study systematically explores the integration of Matahu Lake grass weaving into preschool art education, leading to the following core conclusions: First, the ecological and environmental attributes, artistic aesthetic characteristics, and cultural transmission values of Matahu Lake grass weaving are highly compatible with the enlightenment goals of preschool art education. Its integration can effectively enhance children's aesthetic perception and cultural identity. Second, current integration practices face issues such as vague curriculum objectives, fragmented content, and a lack of evaluation systems, which can be addressed through an integrated strategy framework of "objectives-content-implementation-evaluation. " Finally, building a collaborative mechanism involving "kindergarten-family-community" is a crucial guarantee for achieving dynamic transmission of ICH, as validated by practices in pilot kindergartens.

Future research could deepen in three areas: first, expanding the sample range to explore the adaptability of Matahu Lake grass weaving curricula in kindergartens across different regions; second, extending the research period to track the long-term developmental effects of cultural identity in children; and third, exploring the potential application of AR technology in grass weaving ICH education. This study provides a practical paradigm for the innovative development of ICH culture in the field of preschool education, applicable not only to Matahu Lake grass weaving but also offering valuable references for the integration of other regional ICH with early childhood education.

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Research on Personalized Learning Path Optimization Driven by Big Data

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Abstract: In the context of digital education transformation, optimizing personalized learning paths through big data technology to enhance learning efficiency and adaptability has become a critical issue in educational technology. This study addresses the challenges of insufficient personalization and weak dynamic adaptability in traditional learning path design. An integrated framework combining data mining, machine learning, and path optimization algorithms is proposed. We first construct a multidimensional learning feature model, integrating learner behavior data, competency assessment data, and resource attribute data through educational big data collection and preprocessing techniques. Then, we design a dynamic path recommendation algorithm based on reinforcement learning, modeling paths in conjunction with learners' real-time states and learning goals, achieving intelligent optimization through an adaptive weight adjustment mechanism. Finally, a three-dimensional evaluation metric system encompassing accuracy, fluency, and degree of personalization is established to validate the model's effectiveness across different learning scenarios. Experimental results show that the proposed method significantly outperforms traditional methods in resource matching accuracy, path transition efficiency, and learner satisfaction, effectively enhancing the precision and adaptability of personalized learning. This research provides theoretical support and methodological reference for the in-depth application of big data technology in education, promoting a paradigm shift in personalized learning from experience driven to data driven approaches.

Keywords: Big Data; Personalized Learning; Learning Path Optimization; Machine Learning; Educational Technology

1. INTRODUCTION

1.1 Research Background and Significance

Accelerated global digital transformation in education has led to the continuous development of new educational models represented by MOOCs, smart classrooms, and adaptive learning systems. The vast data generated during learning processes has become a core resource for optimizing educational services. According to the "China Education Informatization Development Report," by 2023, the cumulative registered users of online learning platforms in China exceeded 320 million, generating an average of 1.8 TB of learning behavior data daily, covering multiple dimensions such as learning duration, resource access trajectories, and assessment results. Traditional uniform learning path designs in largescale educational models fail to meet learners' diverse needs regarding knowledge foundations, cognitive styles, and goal orientations, resulting in issues like inadequate resource matching accuracy (average matching accuracy of only 62.3%) and high path transition costs (35% efficiency loss in cross module learning).

The development of big data technology offers a new path to address the challenges of personalized learning. By mining implicit competency features and preference patterns in learner behavior data, dynamic individual learning profiles can be constructed, enabling intelligent planning and real-time adjustment of learning paths. The UNESCO "Digital Transformation in Education Guidelines" highlights that data driven learning analytics technologies are key tools for enhancing educational equity and quality, necessitating breakthroughs in core technologies such as learning process modeling and path optimization algorithms. In this context, this study focuses on the optimization of personalized learning paths driven by big data, aiming to establish an integrated framework combining educational theory, data science,

and algorithm technology to provide methodological support for resolving the contradiction between largescale education and personalized cultivation. The research outcomes not only enrich the theoretical framework in the field of educational technology but can also be directly applied in smart education platform development to achieve "one-to-one" learning support services, holding significant theoretical and practical value.

1.2 Review of Domestic and International Research

International research commenced in the 1990s, initially represented by adaptive hypermedia systems (AHS), which implemented simple path branching via rule engines. With the advancement of machine learning technologies, recommendation algorithms based on collaborative filtering and Bayesian network modeling have been gradually applied to learning path planning. However, such methods rely on static user models, making it challenging to cope with dynamic changes during the learning process. Recently, reinforcement learning (RL) has garnered attention for its advantages in sequential decision-making, exemplified by the DRL4Rec model proposed by DeepMind, which achieves a learning resource dynamic recommendation by constructing a state action space, resulting in an 18% increase in learner completion rates in MOOC platform tests. However, existing research typically suffers from a singular data dimension issue, lacking the ability to model implicit features such as learners' emotional states and cognitive loads.

Since 2010, domestic research has rapidly developed, focusing on the application of educational big data and learning analytics. Scholars have constructed three-dimensional user models encompassing learning styles, knowledge levels, and interest preferences, and proposed path search algorithms based on particle swarm optimization. Some smart learning platforms developed by universities have achieved preliminary path recommendations based on learning logs. However, improvements are needed in the following areas: insufficient depth of data integration, weak handling capabilities for unstructured data (e.g., reflective texts, interactive videos), inadequate algorithm adaptability, and an incomplete evaluation system lacking quantitative analyses of learning path fluency and cognitive load variations.

Overall, existing studies have yet to form a complete technical chain covering "data collection feature modeling path optimization effect evaluation," especially in areas like multimodal data fusion modeling and real-time optimization mechanisms in dynamic environments. This research will focus on the unique characteristics of educational scenarios, aiming to construct a solution that combines theoretical depth and technological innovation, advancing research in the field toward systematic and practical directions.

1.3 Research Objectives and Innovations

The core objective of this research is to establish an efficient and precise personalized learning path optimization system, which specifically includes: ① Developing a multidimensional modeling method that covers both explicit learner behaviors and implicit characteristics, addressing the limitations of traditional models with a single data dimension; ② Designing a dynamic path optimization algorithm based on reinforcement learning to achieve real-time adaptive adjustments of learning paths; ③ Creating a comprehensive evaluation model incorporating cognitive load, learning efficiency, and goal achievement as feedback for optimization strategies.

These innovations will provide new methodological perspectives for optimizing personalized learning paths, promoting a shift in educational technology research from isolated technical applications to systematic solutions.

2. THEORETICAL FOUNDATION AND TECHNICAL FRAMEWORK

2.1 Theoretical Foundation of Personalized Learning

The theoretical foundations of personalized learning trace back to Piaget's cognitive development theory and Vygotsky's zone of proximal development theory. The former emphasizes that individuals construct knowledge systems through assimilation and accommodation mechanisms, while the latter indicates that effective learning should occur within the range of "existing development

level" and "potential development level." Constructivist learning theory further posits that learning is a process in which learners acquire knowledge through meaning construction in specific contexts, necessitating the provision of learning resources and paths that align with individual cognitive structures. These theories collectively establish the core principles of personalized learning: the design of learning paths should fully consider learners' individual differences in knowledge foundations, cognitive styles, and interest preferences, achieving a virtuous cycle of "precise input efficient output" through adaptive adjustments.

In practice, mastery learning theory and multiple intelligences theory provide operational frameworks for personalized learning. Bloom's mastery learning theory advocates determining learners' mastery levels through diagnostic assessments to provide targeted learning materials and instructional strategies. Gardner's multiple intelligences theory emphasizes the differences in individuals across various intelligence dimensions, requiring that learning path designs encompass diverse ability cultivation objectives. These theories collectively form the cognitive basis of this research, guiding the dimensional division of the learner feature model and the deconstruction of learning objectives.

2.2 Big Data Driven Educational Decision-making Model

The application of big data technology in education has given rise to the "data driven decision-making" (DDDM) paradigm, which is fundamentally about using data collection, analysis, and modeling to provide scientific evidence for educational practices. The educational decision-making model constructed in this study consists of three core levels: data layer, analysis layer, and application layer. The data layer integrates multisource data generated by learners in learning platforms, assessment systems, and interactive tools, including structured behavioral logs (e.g., clickstream data, response times), semi structured textual data (e.g., assignment feedback, discussion posts), and unstructured multimedia data (e.g., experimental operation videos, voice Q&A records), achieving data standardization via ETL (extract trans form load) techniques. The analysis layer employs data mining and machine learning techniques to extract learners' competency features, cognitive patterns, and emotional states, constructing dynamic individual learning profiles. The application layer translates analysis results into specific educational decisions, including learning resource recommendations, path node adjustments, and difficulty level adaptations, forming a closed loop system of "data collection intelligent analysis decision execution effect feedback."

The unique value of this model lies in its ability to break through traditional experience driven decision-making patterns by quantifying analyses that reveal implicit regularities in learning processes. For instance, through association rule mining, it was discovered that when learners spend 1.5 times the average duration on certain knowledge points with an accuracy rate below 60%, inserting targeted micro videos into the subsequent path can enhance knowledge acquisition efficiency by 40%. This data evidence-based decision mechanism provides scientific support for precise optimization of learning paths.

2.3 Core Technology System for Learning Path Optimization

Learning path optimization is an interdisciplinary field integrating educational theory, computer science, and cognitive science, involving core technologies such as data processing, model construction, and algorithm design. The technical system constructed in this study includes:

(1) Multimodal Data Collection Technology: This technology employs embedded logs, sensor devices (e.g., eye trackers, EEG caps), and natural language processing (NLP) techniques to achieve comprehensive perception of learners' explicit behaviors (e.g., clicks, submissions) and implicit states (e.g., attention distribution, cognitive load). NLP techniques are used to parse reflective texts and automatically generate keyword tags; eye tracking data identifies learners' attention focus, and the P300 component in EEG signals effectively reflects the depth of knowledge comprehension.

(2) Dynamic Feature Modeling Technology: This technology uses factor analysis and

clustering analysis alongside deep neural networks (DNN) to perform dimensionality reduction and feature fusion on multidimensional data, constructing a mixed model that includes static features (e.g., prior knowledge level, learning goals) and dynamic features (e.g., realtime accuracy, cognitive load change rate). Experiments show that the introduction of dynamic features improves the accuracy of learner state predictions from 72% to 85%.

(3) Intelligent Optimization Algorithms: Based on a reinforcement learning framework, a tuple model comprising learner states (S), learning resource actions (A), and reward functions (R) is defined. The state space integrates dimensions such as knowledge mastery, interest matching, and cognitive load, while the action space encompasses operations like resource recommendations, path transitions, and difficulty adjustments. The reward function optimizes multiple objectives combining learning efficiency (completion time), effectiveness (test scores), and experience (cognitive load changes). Through QLearning algorithm iterative training, path strategies are autonomously optimized, reducing average learning path lengths by 23% in simulated environments.

The organic integration of these technologies forms an adaptive learning path optimization system that dynamically adjusts strategies based on learners' real-time states, facilitating a paradigm shift from "resource centered" to "learner centered."

3. MULTIDIMENSIONAL LEARNING FEATURE MODELING METHOD

3.1 Learner Data Collection and Preprocessing

Data collection adheres to principles of comprehensiveness, timeliness, and privacy protection, constructing a collection system encompassing three data source categories: ① Platform Interaction Data: Learning resource access records (e.g., video viewing durations, chapter stay times), assignment submission logs (e.g., problem-solving steps, error types), and test score data (e.g., scores per knowledge point) are obtained through frontend embedding. ② Competency Assessment Data: Computer adaptive testing (CAT) dynamically evaluates learners' knowledge mastery levels, calculating potential trait parameters (θ) using Item Response Theory (IRT) to reflect individual capabilities across different knowledge dimensions. ③ Implicit State Data: Eye trackers collect fixation point trajectories and pupil diameter changes, while affective computing techniques analyze facial expressions (e.g., frequency of furrowing brows reflecting cognitive difficulty) within the learning interface, simultaneously recording alpha (reflecting relaxed states) and beta wave (indicating focused attention) EEG signals.

During preprocessing, a multilayer cleaning strategy is employed: first, missing data is addressed through imputation (Knearest neighbors algorithm), continuous variables (e.g., learning duration) are standardized using Zscores, and categorical variables (e.g., resource types) are one hot encoded; second, noise detection algorithms (local outlier factor) are utilized to identify and filter outliers, such as daily learning durations exceeding 10 hours (approximately 1.2% of records); finally, principal component analysis (PCA) reduces high dimensional data, compressing the original 120dimensional feature vector to 30 dimensions while retaining 92% of information entropy, thereby enhancing modeling efficiency. This data preprocessing process ensures the quality and structure of the feature vectors input into the model, laying a foundation for subsequent modeling.

3.2 Deconstruction of Learning Ability Dimensions and Indicator Construction

Based on educational psychology theories, learning abilities are deconstructed into three core dimensions: cognitive ability, metacognitive ability, and emotional ability, each containing specific measurable sub indicators:

(1) Cognitive Ability Dimension: A three-level indicator system encompassing knowledge mastery, problem-solving ability, and knowledge transfer ability is constructed. Knowledge mastery is quantified through the IRT parameter (θ) value in CAT tests, problem-solving ability is comprehensively assessed using the correct solution time (T) and step completeness (C) for complex problem types in assignments (formula: PSC=0.6T+0.4C), and knowledge transfer

ability is calculated using the correct rate (R) and response time (RT) for interchapter analogy questions (formula: RTC=R/RT).

(2) Metacognitive Ability Dimension: This dimension focuses on learners' self-monitoring and strategy use, comprehensively assessing reflective text analysis in learning logs (using LDA topic modeling to extract frequencies of three themes: "planning," "monitoring," and "evaluation"), clarity of learning goal setting (SMART principal compliance scoring), and frequency of progress adjustments (number of path modifications per week).

(3) Emotional Ability Dimension: Measurement includes learners' emotional states during the learning process (probability of facial expressions indicating pleasure/frustration), learning engagement (proportion of effective fixation durations in eye tracking data), and achievement motivation (frequency of actively challenging high difficulty tasks), with the engagement indicator showing a significant positive correlation with academic scores (Pearson correlation coefficient $r=0.73$, $p<0.01$).

Weights for each dimension indicator are determined using the Analytic Hierarchy Process (AHP), constructing a competency feature model comprising 12 primary indicators and 36 secondary indicators. This model not only characterizes learners' static ability levels but also reveals developmental trajectories of competencies through time series analysis, providing real-time state inputs for dynamic path optimization.

3.3 Semantic Modeling of Learning Objectives and Resource Attributes

To address the complexity of learning objectives and the diversity of resource attributes, ontological and natural language processing techniques are utilized for semantic modeling. Initially, a Learning Goal Ontology is constructed, breaking down cultivation objectives into three top level concepts: knowledge, skills, and competencies. Each concept is further subdivided into specific dimensions (e.g., the knowledge dimension includes cognitive levels such as "understanding," "application," and "analysis"), defining hierarchical relationships and property constraints between concepts using OWL language. For example, the objective "mastering basic algorithms of machine learning" can be mapped to the "knowledge application" level, associating it with specific knowledge points such as "linear regression" and "decision trees."

Resource attribute modeling encompasses both content characteristics and structural features: content characteristics are extracted through text tokenization and named entity recognition (NER) to identify keywords, utilizing Word2Vec to generate semantic vectors (100dimensional) for quantifying resource themes; structural features describe resources' positions within the knowledge graph, including predecessor/successor knowledge points, difficulty levels (15), and presentation formats (text/video/experiment). By calculating semantic similarity (cosine similarity), mapping relationships between learning objectives and resource content are established, triggering recommendation mechanisms when the goal resource similarity exceeds a threshold (0.75). Experiments indicate that this modeling approach improves resource theme matching accuracy from 68% (traditional keyword matching) to 82%, effectively addressing issues of semantic ambiguity and implicit association recognition. Semantic modeling techniques provide logical support at the knowledge level for learning path optimization, enabling systems to comprehend the deep connections between objectives and resources, thus generating learning sequences aligned with cognitive logic and avoiding the "information cocoon" problem caused by purely behavioral data driven recommendations.

4. DYNAMIC LEARNING PATH OPTIMIZATION MODEL CONSTRUCTION

4.1 Definition of Path State Space Based on Reinforcement Learning

The design of the state space within a reinforcement learning framework must accurately map the real-time characteristics of learners to the attributes of the learning environment. This study constructs a state vector comprising four key dimensions:

Knowledge State: Represented by latent trait parameters calculated through Item Response Theory, encompassing mastery distribution across 12 knowledge domains.

Ability State: A normalized vector integrating cognitive abilities (time taken to solve problems, completeness of steps), metacognitive abilities (frequency of reflective log keywords), and emotional factors (eye movement engagement metrics).

Resource State: Describing the knowledge graph attributes of the current learning node, including the correlation of prerequisite knowledge points (range 01), difficulty level (quantified on a scale of 15), and presentation format encoding (one hot vector).

Environmental State: Incorporating contextual parameters such as learning period (entropy reflecting fatigue) and device terminal (impacting interaction mode).

The dynamic adjustment mechanism for state space dimensions is realized through an attention gated network, which automatically focuses on key features based on the learning phase. For instance, the knowledge state weight is emphasized during the initial construction phase (40%), while the ability state weight is amplified during the application phase (50%). After 2000 simulation training cycles, this dynamic state representation improved the convergence speed of the policy network by 35% and reduced the entropy of the state transition matrix by 22%, effectively addressing the inadequacy of traditional fixed dimension state spaces in representing complex learning scenarios.

4.2 Design of Adaptive Weight Adjustment Mechanism

The weight adjustment mechanism aims to balance the Mult objective optimization of learning efficiency, effectiveness, and experience. The reward function is composed of three weighted components:

Efficiency Reward: Based on the Pareto optimal solution of path length and completion time.

Effectiveness Reward: Related to the increase in knowledge point mastery (quantified by the difference in parameters from pre and posttest).

Experience Reward: Synthesized from the rate of change in cognitive load (pupil diameter fluctuation) and interest matching degree (cosine similarity of resource semantic vectors).

The weight vector is dynamically optimized through a dual network architecture: the evaluation network fitting the state value function, while the policy network generates the action probability distribution, employing Proximal Policy Optimization to update parameters, thus mitigating the optimization target deviation caused by traditional fixed weights.

Empirical analysis shows that when the learner's cognitive load index exceeds a threshold (0.75), the system automatically increases the weight of experience rewards, triggering low difficulty resource recommendation strategies, leading to a 28% reduction in error rates for the subsequent three nodes. This mechanism overcomes the adaptability limitations of traditional static weight models, achieving dynamic strategy balance across varying learning contexts.

4.3 Implementation of Path Optimization Algorithm and Complexity Analysis

The algorithm follows a "state awareness action decision feedback update" cycle: real-time state vectors are obtained via multimodal data interfaces, compressed through a feature fusion layer, and input to the policy network. The action space includes 12 basic operations (e.g., resource recommendation, difficulty adjustment, path branching), with the output layer employing a SoftMax function to generate action probability distributions. After executing actions, new states and reward values are collected for training the deep neural network via an experience replay pool.

Time complexity analysis indicates that single decision computations meet the real-time requirements of online learning systems (response latency<50 ms), with single node decision-making time around 12 ms. Space complexity primarily arises from experience replay pool and model parameter storage; after adopting a prioritized experience replay strategy, memory usage is reduced by 40% compared to traditional methods. In a distributed environment with 50,000 learners, the algorithm cluster can support an average of 800,000 path optimization requests daily, demonstrating good engineering scalability.

5. EVALUATION METRICS SYSTEM AND EXPERIMENTAL VERIFICATION

5.1 Construction of a Three-dimensional Evaluation Metrics System

An evaluation framework encompassing

accuracy, fluency, and personalization is established:

Resource matching accuracy: The proportion of correctly recommended resources to total recommendations (semantic matching above threshold 0.75 considered correct).

Goal achievement degree: Calculated by the ratio of the difference in knowledge mastery between posttest and pretest to the target increment (reflecting knowledge mastery progress).

Timeliness of error intervention: The ratio of cases adjusting paths within two steps after the first error to total error cases.

Path transition efficiency: The ratio of effective learning time to total time (excluding ineffective transitions and redundant learning time).

Cognitive load fluctuation index: Measured by the ratio of pupil diameter standard deviation to average diameter (smaller values indicate more stable cognitive load).

Knowledge graph traversal depth: The ratio of the actual number of accessed nodes to the optimal path nodes (reflecting path compactness).

Learner satisfaction: Assessed via a 5point Likert scale score (including 6 items related to resource relevance and difficulty adaptability).

Path customization index: Calculated by the ratio of the number of individual specific path nodes to total path nodes (reflecting individual differences).

Interest expansion degree: The proportion of time spent on new domain resources (reflecting the system's ability to uncover latent interests).

Each metric's validity is verified through structural equation modeling, showing a cumulative explained variance of 78.3% across the three dimensions, indicating strong construct validity.

5.2 Experimental Design and Data Sources

The experiment employs a quasiexperimental design, utilizing data from an online learning platform of a university, involving 1200 learners (600 in the experimental group, 600 in the control group) and 32 courses (totaling 2876 learning resources). The experimental group employs the dynamic optimization model proposed in this study, while the control group uses traditional collaborative filtering algorithms and rule based static models. Data collection encompasses platform interaction logs, ability assessment data, and implicit state data (eye tracking data).

Controlled variables include learners' initial knowledge levels, learning goal types, and terminal devices, with a testing period of 16 weeks, analyzing intergroup differences through repeated measures ANOVA.

5.3 Comparative Methods and Result Analysis

Comparative algorithms include traditional collaborative filtering (CF), rule based static models (RB), and the proposed deep reinforcement learning model (DRL).

Results indicate that the DRL model significantly outperforms control methods in key metrics such as resource matching accuracy, path transition efficiency, and learner satisfaction ($p<0.01$). The cognitive load fluctuation index in the DRL group is significantly lower than in the control group, demonstrating the effectiveness of the dynamic adjustment mechanism in reducing cognitive fatigue during the learning process. In various learning goal contexts, the DRL model shows differentiated advantages: greater improvements in knowledge transfer ability under innovative goals and more significant achievement under foundational mastery goals. Eye tracking data validates the model's optimized allocation of attentional resources.

6. CONCLUSION

This study constructs a big data driven personalized learning path optimization system, with major contributions including:

Proposing a three-layer architecture that integrates educational theory and data science, addressing the single dimensionality of traditional data methods, improving resource matching accuracy from 68% to 89.7%, and offering a new paradigm for precise learning support.

Designing a dynamic optimization mechanism based on reinforcement learning, achieving Realtime intelligent planning of learning paths through dynamic adjustment of state space and adaptive weight allocation, leading to a 23% increase in path transition efficiency and a 44% improvement in cognitive load stability, effectively balancing learning outcomes and experience.

Developing a three-dimensional evaluation system encompassing accuracy, fluency, and personalization, with empirical research validating the model's effectiveness, providing quantifiable evaluation standards for educational technology applications.

The findings promote a transition from experience driven to data driven educational decision-making, offering direct guidance for the development of smart education platforms.

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A Study on the Management Model of Smart Education in Higher Education Empowered by Technology

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Abstract: This study focuses on the theoretical construction and practical pathways of technology empowered smart education management models in the context of digital transformation in education. It aims to address issues in traditional educational management such as data silos, delayed decision-making, and insufficient service precision, providing theoretical support for the modernization of higher education governance. Utilizing bibliometric analysis, system dynamics modeling, and comparative analysis, the research first employs the Citespace visualization tool to analyze 2376 relevant publications from Web of Science and CNKI databases between 1998 and 2024, establishing a tridimensional analytical framework of "Technology Empowerment Management Trans formation Education Ecology." It then examines the integration mechanisms of technologies like 5G, big data, and digital twins within educational management from the perspectives of IoT perception, blockchain governance, and AI decision-making, identifying three core models: data driven decision-making, intelligent collaborative governance, and personalized service management. Finally, a smart education management effectiveness evaluation framework is developed based on a maturity model, comprising four primary indicators and twelve secondary indicators, with structural equation modeling validating the positive impact of technology empowerment on management effectiveness (β=0.682, P<0.001). The study reveals that the core features of the smart education management model include a transition to data driven decision paradigms, the restructuring of management processes through intelligent technologies, and the reshaping of educational governance relationships through ecological concepts, all of which rely on the collaborative evolution of institutional innovation and technology application. The findings provide a replicable theoretical model and implementation framework for advancing smart education management in higher education.

Keywords: Smart Education Management; Technology Empowerment; Modernization of Education Governance; Data Driven Decision-making; Management Model Innovation

1. INTRODUCTION

1.1 Research Background and Problem Statement

Amid the accelerated global digital transformation in education, new information technologies represented by 5G, AI, and blockchain are profoundly reshaping governance paradigms in higher education. The "China Education Modernization 2035" plan explicitly states the strategic goal of "constructing an intelligent education support environment," while the Ministry of Education's "14th Five-year Plan for Educational Informatization" further demands the "promotion of digital transformation in education management to enhance governance effectiveness." However, the current landscape of educational management in universities faces multiple challenges: according to the 2024 Ministry of Education report, 68% of universities have barriers to cross departmental data sharing, 45% rely on experiential judgment rather than data driven approaches for decision-making, and 32% do not effectively respond to personalized service needs of students. The issues of information asymmetry, redundant processes, and delayed services under traditional hierarchical management modes starkly contradict the

student-centered educational philosophy and the demands for precise governance in contemporary times.

Technology empowerment offers a new pathway to address these challenges. For instance, integrating IoT sensing devices into educational management systems can enhance campus energy monitoring accuracy to 92%, while AI algorithms can achieve an 87% accuracy rate in student academic alerts, and blockchain technology can reduce degree certification processes from seven days to two hours. However, despite these technological efficiencies, a systematic management model innovation has yet to emerge. Existing research often focuses on singular technological applications, lacking a comprehensive construction of the "technology in stationman" collaborative mechanism, causing technology empowerment to remain at the tool replacement level without achieving fundamental reform in educational management paradigms. In this context, exploring innovative models and implementation pathways for technology empowered smart education management in higher education emerges as a crucial topic for addressing the challenges of educational governance modernization.

1.2 Research Objectives and Theoretical Value

This study aims to construct a theoretical framework for the transformation of education management models driven by technology empowerment, elucidating the components, mechanisms, and implementation pathways of smart educational management models. The specific research objectives include: ① Deconstructing the coupling logic between technology empowerment and educational management to build a tridimensional analytical model comprising "Technology Empowerment Layer Management Transformation Layer Ecological Evolution Layer"; ② Extracting the core connotations of data driven decision-making, intelligent collaborative governance, and personalized service provision; ③ Designing an implementation pathway system that includes institutional innovation, capacity building, and ecological construction; ④ Developing a universally applicable effectiveness evaluation tool for smart education management. Theoretically, the study breaks through the limitations of traditional educational management theories, viewing technology as a core element shaping management paradigms. By integrating complex systems theory and digital transformation theory, it reveals the entropy reduction mechanism within the management system induced by technology empowerment, enriching the digital transformation dimension of educational governance theories. Practically, the results provide theoretical guidance for universities in formulating smart education management strategies, helping solve real issues such as chaotic data governance, inefficient business collaboration, and delayed service provision, promoting a paradigm shift in educational management from experience driven to data driven, from hierarchical to networked, and from standardized to personalized approaches.

1.3 Review of Domestic and International Research Status

1.3.1 Evolution of the Concept of Smart Education Management

The concept of smart education management has evolved through three stages: the early germination stage (20002010) alongside the construction of educational informatization 1.0, focusing on the application of information technology in office automation; the model formation stage (20112020), with the popularization of big data technologies and the introduction of the concept of "intelligent educational management," emphasizing the role of data mining in decision support; and the ecological construction stage (2021present), under the promotion of the "digital education" strategy, forming a comprehensive conceptual system of "smart education management" that focuses on the systematic reconstruction of educational governance ecology through technology empowerment. Domestic scholar Huang Ronghuai posits its core features as "data intelligencedriven, business process reengineering, and multistakeholder collaboration," while the international journal "Educational Technology Research and Development" emphasizes "the precision of management decisions and the personalization of services through technology

empowerment."

1.3.2 Research Progress on Technology Empowerment Pathways

Research on technology empowerment pathways in educational management exhibits interdisciplinary characteristics: the computer science domain emphasizes algorithm optimization, such as student behavior prediction models based on BP neural networks; the field of educational management focuses on institutional adaptation, proposing a three stage model of "technology acceptance process reengineering culture reshaping"; and from the perspective of complex systems theory, collaborative evolution models between technology and management are constructed to reveal emergent phenomena under nonlinear interactions. Specific technology applications, such as blockchain's efficiency in academic integrity management and digital twins in campus resource scheduling, have become research hotspots, but the synergistic effects of combined technology applications remain insufficiently elucidated.

1.3.3 Comparative International Analysis

American universities have built personalized education management systems through the "Learning Analytics Initiative," with 85% of public universities deploying machine learning based academic alert platforms; the European Union promotes the "Digital Campus 2030" plan, focusing on blockchain degree certification and smart contract management; Singapore has implemented the "Smart Campus @SG" project, creating an integrated IoT system covering teaching, management, and daily life. Compared to international practices, Chinese universities have a latecomer advantage in technological application innovation (e.g., in metaverse management scenarios) and ecological integration, but gaps exist in data governance standardization (only 37% of universities have established data asset catalogs) and the construction of ethical frameworks (less than 20% coverage of ethical review institutions).

1.4 Research Methods and Technical Route

This study employs a combination of research methods: ① Bibliometric analysis through Citespace for visualizing 2376 documents from Web of Science (19982024) and CNKI (20002024) to identify research hotspots and evolution; ② System dynamics modeling to construct causal relationship models between technology empowerment and educational management, simulating system evolution paths under varying technology investment scenarios; ③ Structural equation modeling (SEM) based on survey data from 127 universities (with a valid sample size of 3128) to verify the impact mechanisms of technology empowerment on management effectiveness; ④ Comparative research, selecting typical cases such as MIT, National University of Singapore, and Tsinghua University for cross-cultural comparison.

The technical route follows a logical chain of "theoretical construction current status diagnosis model innovation path design": first, it constructs an analytical framework through literature research and theoretical deduction; then it analyzes the practical challenges of technology empowerment using empirical methods; subsequently, it extracts core models based on case induction and model derivation; finally, it designs an operational pathway system in conjunction with institutional environments and implementation conditions. Data sources include publicly available statistics from the Ministry of Education, annual reports on university informatization, field interview records (involving 87 individuals including administrators, teachers, and students from nine universities of varying levels), and onsite observations of technology application scenarios.

2. THEORETICAL FOUNDATION OF TECHNOLOGY EMPOWERMENT IN SMART EDUCATION MANAGEMENT

2.1 Core Concept Definitions

2.1.1 Smart Education

Smart education represents an advanced form of educational informatization, referring to the construction of an educational ecosystem characterized by situational awareness, data driven approaches, and intelligent decision-making through technologies such as IoT, AI, and big data. Its core features include: ① comprehensive data collection through intelligent terminals to digitally map teaching, management, and daily life scenarios; ② deep intelligent processing, utilizing machine learning algorithms for correlation analysis and trend forecasting of educational data; ③

dynamic service adaptation, generating personalized solutions in real-time based on user needs. Compared to traditional digital education, smart education emphasizes the deep integration of technology and education, as well as the system's self-optimization capabilities.

2.1.2 Educational Management Model

An educational management model is a systematic solution composed of management objectives, entities, mechanisms, and resources guided by specific educational philosophies. Traditional models are based on hierarchical structures, characterized by pyramid shaped power structures, standardized process controls, and experiential decision-making. In contrast, smart educational management models center on data as the core production factor, constructing flattened governance structures, agile business processes, and precise decision-making mechanisms, achieving a paradigm shift from "managing by people" to "managing by data."

2.1.3 Technology Empowerment Theory

Technology empowerment theory, rooted in Schumpeter's innovation theory and Pearce's technology economics paradigm theory, refers to the process whereby technological advances enhance organizational capacity and model innovation by altering the configuration of production factors. In the context of educational management, technology empowerment manifests in three dimensions: ① tool empowerment, improving operational efficiency through technology applications (e.g., RPA reducing 70% of administrative repetitive tasks); ② structural empowerment, breaking down departmental barriers through data flow and reconstructing organizational collaborative relationships; ③ ecological empowerment, fostering new governance entities and regulatory frameworks through technological innovations, such as students participating in academic management via educational blockchain.

2.2 Theoretical Support System

2.2.1 Educational Governance Theory

Educational governance theory emphasizes the participation of multiple entities, collaborative governance, and institutional innovation, providing value orientation for smart educational management. Technology empowerment expands governance entities from solely administrative departments to include teachers, students, and enterprises, allowing students to provide real-time feedback on management service demands via intelligent terminals, and enabling enterprises to participate in educational resource allocation based on data sharing. Governance mechanisms shift from administrative orders to data driven collaborative decision-making, exemplified by the automatic execution of scholarship disbursement rules through smart contracts, achieving transparency and automation in governance processes.

2.2.2 Complex Systems Theory

University educational management systems are complex mega systems comprising subsystems such as teaching, research, and administration, characterized by nonlinearity, dynamics, and self-organization. Technology empowerment reduces system disorder by introducing negative entropy flows (e.g., high-quality data input and intelligent algorithm optimization): when the integration rate of data platforms exceeds 60%, the coordination efficiency of management systems significantly improves. Complex systems theory explains emergent phenomena triggered by technological applications, such as the potential for Mult technology integration to produce synergistic effects that exceed the sum of individual technological efficiencies, thereby forming a unique model of smart educational management.

2.2.3 Digital Transformation Theory

Digital transformation theory reveals the inherent laws governing the transition of organizations from the industrial age to the digital age, encompassing three stages: technology restructuring, process reengineering, and cultural reshaping. In the field of educational management, technology restructuring is reflected in the intelligent upgrading of infrastructure (e.g., universities with 95% coverage of 5G campus networks experience a 40% increase in management response speed); process reengineering manifests as the digital reconfiguration of business logic, such as blockchain based research results verification reducing the recognition cycle by 60%; and cultural reshaping is demonstrated through the cultivation of datacentric thinking, with a 75%

adoption rate of data driven decision-making when the data literacy compliance rate of managers exceeds 80%.

2.3 Construction of the Technology Education Management Coupling Model

Based on technology empowerment theory and complex systems theory, a tridimensional coupling model of "Technology Empowerment Management Transformation Ecological Evolution" is constructed. The technology empowerment layer includes foundational technologies (IoT, 5G), core technologies (AI, blockchain), and frontier technologies (digital twins, metaverse), forming a technology support system through data collection, processing, and application. The management transformation layer encompasses decision-making models (from experience to data driven), governance structures (from hierarchical to networked collaboration), and service forms (from standardized to personalized), achieving a spiral enhancement of management effectiveness. The ecological evolution layer reflects the interactive feedback between technology and management, where technological applications generate new governance demands (e.g., data privacy protection), and management transformations drive technological innovations (e.g., customized algorithm development), creating a virtuous cycle of "technology empowerment management innovation ecological reconstruction."

In this model, the mechanisms of technology empowerment are manifested as: ① activation of data elements, transforming physical campuses into digital twins through IoT, generating an average of 10TB of management data daily to fuel decision-making; ② reconfiguration of business processes, with AI algorithms automating 70% of routine administrative tasks, allowing managers to focus on strategic decision-making; ③ restructuring of relational networks, with blockchain technology achieving decentralized verification of cross departmental data sharing, improving data transfer efficiency between departments by 85%. This model provides a visual framework for understanding how technology translates into management effectiveness, serving as a logical starting point for subsequent research.

3. ANALYSIS OF THE TECHNICAL EMPOWERMENT SYSTEM FOR SMART EDUCATION MANAGEMENT IN HIGHER EDUCATION INSTITUTIONS

3.1 Basic Empowerment Layer: Construction of the Educational IoT and Data Middleware

The Educational IoT serves as a bridge between the physical and digital worlds, enabling comprehensive connectivity of campus management elements through the deployment of smart sensors, RFID tags, and cameras. In educational management, smart desks collect realtime data on student classroom behaviors (e.g., engagement rates, interaction frequencies), providing microlevel support for academic performance analysis. In logistics management, water and electricity metering sensors achieve minute level energy consumption data collection, with a "dual carbon" pilot university leveraging IoT monitoring to reduce energy consumption per unit area by 18% (Source: Journal of Higher Education Logistics, 2024). By 2024, the IoT device coverage in "Double First Class" universities has reached 92%, while local universities average only 65%, highlighting a significant digital divide (Source: Ministry of Education).

Data middleware acts as the core hub for data governance, integrating data from disparate systems such as academic affairs, student services, and finance through ETL (Extract, Transform, Load) technology to establish unified data standards and asset catalogs. After a comprehensive university constructed its data middleware, the response time for cross departmental data sharing requests was reduced from 3 working days to 2 hours, and the data query hit rate increased to 91% (Source: Field Survey Case Study, 2024). Key components of data middleware construction include: 1) Establishing data governance mechanisms, such as formulating "Data Classification and Management Methods" and "Data Sharing Interface Standards"; 2) Building technical platforms using microservices architecture for modular deployment and reduced system coupling; 3) Operating data assets through data visualization tools (e.g., Tableau, Power BI), resulting in an average daily usage frequency

of 2,300 for visualization reports, a 370% increase compared to preconstruction (Source: Same as above).

3.2 Core Empowerment Layer: AI Decision Making and Blockchain Governance Applications

Artificial intelligence (AI) supports decision-making in educational management in three primary areas: 1) Predictive decision-making using LSTM neural networks for student academic warning models, achieving an identification accuracy of 89% for students at risk of dropout (Source: Open Education Research, 2024); 2) Optimizing decision-making through genetic algorithms for resource allocation problems, with a smart scheduling system in one university raising classroom utilization from 68% to 85% and reducing teacher scheduling conflicts by 42% (Source: Chinese University Teaching, 2024); 3) Autonomous decision-making via rule engine based intelligent customer service systems that automatically handle 85% of student inquiries, maintaining a response time within 30 seconds (Source: Modern Educational Technology, 2024). The effectiveness of AI decision-making relies on high-quality data inputs, where research shows that a 10% improvement in data cleanliness increases model prediction accuracy by 6.5% (Source: Regression Analysis Results of This Study).

Blockchain technology fosters a decentralized trust mechanism in educational governance. In academic management, processes such as paper publication and patent applications are recorded onchain; a pilot blockchain academic library at a university saw academic misconduct reports decrease by 60% (Source: Degree and Graduate Education, 2024). In student management, a digital student ID based on consortium blockchain integrates functions like attendance, consumption, and library borrowing, achieving a transaction processing speed of 500 TPS (transactions per second) (Source: Chinese Education Informatization, 2024). In resource management, smart contracts automate scholarship distribution rules, reducing human errors from 5% in traditional methods to 0.3% (Source: Educational Finance Research, 2024). The core challenge in blockchain applications lies in designing consensus mechanisms, balancing efficiency and security; currently, most university consortium blockchains employ an improved PBFT (Practical Byzantine Fault Tolerance) algorithm, with consensus achievement times controlled within 200 ms (Source: Computer Application Research, 2024).

3.3 Innovative Empowerment Layer: Digital Twin Campuses and Metaverse Management Scenarios

Digital twin campuses utilize BIM (Building Information Modeling) and IoT data integration to create a 1:1 digital mirror of the physical campus, enhancing visualization and predictability in management scenarios. In equipment management, a digital twin system simulates the operational status of air conditioning units, achieving a fault prediction accuracy of 93% and reducing maintenance response time by 40% (Source: Experimental Technology and Management, 2024). In emergency management, virtual simulations of campus epidemic transmission paths provide data support for prevention plan formulation, with one university shortening close contact tracing time from 6 hours to 40 minutes based on this technology (Source: Chinese Higher Education Research, 2024). The deep application of digital twin technology depends on high precision modeling and realtime data synchronization; currently, the completion rate of digital twin campus construction in "Double First-class" universities is 45%, but the high cost of 200 CNY per square meter for 3D modeling remains a primary constraint (Source: Special Report on the Development of Education Informatization, 2024).

Metaverse technology creates immersive interactive scenarios for educational management. In recruitment promotion, virtual campus tour systems increased visits by 200%, boosting new student conversion rates by 15% (Source: University Recruitment, 2024). In student affairs management, metaverse meeting rooms support realtime interactions across regions, enhancing the efficiency of student organization meetings by 30% (Source: Chinese Youth Studies, 2024). In faculty development, virtual simulation teaching laboratories provide new teachers with teaching practice environments, improving teaching skill assessment pass rates

from 72% to 89% (Source: Teacher Education Research, 2024). Metaverse applications must address key issues such as digital identity authentication and virtual asset rights, with universities generally adopting "Blockchain + Biometric" technology to construct a metaverse identity system, achieving an identity verification accuracy of 99.99%.

3.4 Key Bottlenecks and Breakthrough Paths of Technical Empowerment

Current technical empowerment faces three major bottlenecks: 1) Data governance dilemmas, with 62% of universities lacking unified data standards and 38% encountering data quality issues (e.g., missing fields, inconsistent formats) (Source: 2024 Education Management Data Governance White Paper); 2) Ethical risks in technology, with insufficient interpretability of AI decision-making (only 23% of universities have established algorithm transparency mechanisms), and blockchain applications potentially leading to excessive data collection issues (Source: Ethics and Practice, 2024); 3) Organizational adaptation barriers, with 41% of managers expressing resistance to technology adoption and 28% of universities lacking supportive institutional frameworks for technology applications.

Breakthrough paths include: 1) Constructing a "Technology + Institution" dualdriven data governance system, formulating "Data Standards for Education Management," establishing data governance committees, and utilizing federated learning technology to achieve "data available but not visible," enhancing data utilization efficiency while protecting privacy (Source: Big Data, 2024); 2) Establishing a technology ethics governance framework, forming AI ethics review committees, developing "Ethical Guidelines for Educational Management Technology Applications," and requiring a decision transparency level of at least 70% for intelligent systems (Reference: IEEE Global Technology Ethics Standards, 2023); 3) Implementing organizational change promotion plans, integrating digital literacy into management personnel evaluations (requiring a minimum of 40 hours of technical training annually), and establishing a collaborative promotion mechanism for "Technology Application Process Reengineering Cultural Reshaping," with one university increasing the technology adoption rate among managers from 55% to 88% through organizational change (Source: Chinese University Science and Technology, 2024).

4. MULTIDIMENSIONAL CONSTRUCTION OF SMART EDUCATION MANAGEMENT MODELS

4.1 Data Driven Decision-making Model

The data driven decision-making model is based on comprehensive data collection, transitioning management decisions from experiential judgments to quantitative analysis through machine learning algorithms. In the academic performance analysis submodel, universities employ natural language processing to analyze interaction data from student online learning platforms, combining 37 dimensions of data on attention distribution and question frequency collected from classroom behavior sensing devices to create dynamic academic warning models. An intelligent analysis system deployed by a research university has shown that the model achieves an identification accuracy of 89.3% for students at risk of graduation delay, increasing efficiency by 60% compared to traditional manual assessments (Source: Higher Engineering Education Research, 2024). The resource allocation sub model optimizes resource scheduling through genetic algorithms; for example, a smart scheduling system that considers course attributes, teacher preferences, and student traffic has increased classroom utilization from 65% to 87%, while reducing equipment idle rates by 42% (Source: Chinese University Teaching, 2024). The quality monitoring sub model relies on blockchain technology to establish a teaching process certification system, recording data from course evaluations, internship records, and research outcomes onchain; after pilot implementation at a university, teaching accident traceability efficiency improved by 75%, and quality complaints decreased by 58% (Source: Degree and Graduate Education, 2024).

4.2 Intelligent Collaborative Governance Model

The intelligent collaborative governance model breaks down departmental barriers

inherent in traditional hierarchical management through the digital reconstruction of business processes and the creation of a multistakeholder network. Cross departmental process reengineering, with the data middleware as a hub, connects 18 business systems in academic affairs, student services, and finance, achieving online coordination for 32 processes including admissions, student status changes, and scholarship evaluations. After process reengineering, the average processing time for student affairs at a local university was reduced from 4.2 working days to 45 minutes, and cross departmental data sharing frequency increased by 300% (Source: Chinese Education Informatization, 2024). A family school community collaborative mechanism utilizing consortium blockchain technology establishes a triparty data sharing platform, allowing parents to access student performance data through biometric authorization and enabling enterprises to participate in curriculum development based on desensitized talent cultivation data. A collaborative platform cobalt by a university in Shenzhen and Huawei demonstrated that feedback speed for corporate needs was shortened from quarterly to hourly, with the alignment rate of graduates' majors improved by 22% (Source: Higher Engineering Education Research, 2024). The networked transformation of governance structures gives rise to new decision-making mechanisms, such as automatically executing academic integrity review rules through smart contracts, reducing review cycles from 21 days to 72 hours and decreasing manual intervention by 80% (Source: Research Management, 2024).

4.3 Personalized Service Management Model

The personalized service management model achieves precise service provision based on student digital profiles. Student development profiles integrate over 200 dimensions of information, including learning trajectories, social behaviors, and health data, utilizing autoencoder algorithms to generate dynamic capability maps. The profiling system at a "Double FirstClass" university has covered 98% of enrolled students, providing accurate data for career planning and psychological counseling (Source: Open Education Research, 2024). The precise service provision system includes two main mechanisms: intelligent recommendations and adaptive adjustments. In resource recommendation, a learning platform based on collaborative filtering algorithms sends personalized materials an average of 32,000 times daily, achieving a student satisfaction rate of 89% (Source: Modern Educational Technology, 2024). In daily services, an intelligent dormitory system combining IoT and AI automatically adjusts lighting and temperature based on students' schedules, reducing energy consumption by 19% (Source: Journal of Higher Education Logistics, 2024). Innovations in service models significantly enhance student satisfaction, with nationwide surveys indicating that universities implementing personalized services see a 63% reduction in student affairs complaints compared to traditional models (Source: Chinese Higher Education Research, 2024).

4.4 Core Elements and Logical Relationships in Model Construction

The construction of smart education management models encompasses three core elements: technical empowerment, data driven approaches, and ecological collaboration. Technical empowerment serves as the foundational support, utilizing technologies such as IoT, AI, and blockchain to achieve digital mapping of the physical world and automate management processes. The data driven approach constitutes the operational core, with data elements permeating decision-making, governance, and service processes, forming a closed loop optimization mechanism of "collection processing application feedback." Ecological collaboration shapes governance forms, enabling multiple stakeholders to reconstruct responsibilities and collaboratively govern through digital platforms. The logical relationship among these elements manifests as follows: technical empowerment activates the value of data elements, data flow compels the transformation of governance structures, and ecological evolution fosters technological innovation and data application, collectively forming a "Technology Data Ecology" spiral ascending system. Empirical research indicates that when the maturity of technical empowerment, level of data governance, and

degree of ecological collaboration are all above moderate levels, management effectiveness can improve by 40%60% (Source: Structural Equation Model Analysis Results of This Study).

5. IMPLEMENTATION PATH OF SMART EDUCATION MANAGEMENT MODELS

5.1 Institutional Innovation: Designing a Digital Policy Framework for Educational Management

Institutional innovation is the foundational guarantee for technology application, requiring the establishment of a threetier policy system of "strategic planning standard specifications implementation details." At the top level, reference the "14th FiveYear Plan for Educational Informatization" to develop a special program for smart education management in universities, clarifying timelines and roadmaps for data governance, technology application, and organizational change, such as requiring all undergraduate institutions to complete data middleware infrastructure by the end of 2025 (Source: Ministry of Education, 2022). In the standard specifications tier, formulate 12 core institutional documents, such as the "Guideline for Classifying and Grading Data in Educational Management" and "Technical Standards for Intelligent System Access," to unify data interface standards and security level classifications, addressing interoperability challenges (Source: China Education News, 20240520). In the implementation details tier, establish an ethical review system for technology applications, stipulating that intelligent decision systems must pass interpretability tests (decision basis transparency ≥70%) before going live, and that data collection requires explicit user consent with storage periods not exceeding 5 years (Reference: IEEE Education Technology Ethics Guidelines, 2023).

5.2 Capacity Building: Enhancing Digital Literacy Among Managers

The digital literacy of managers is a critical variable in model implementation, necessitating the establishment of a closed loop enhancement system comprising "diagnosis training assessment." The literacy diagnosis utilizes an evaluation tool featuring 18 indicators across three dimensions: technical cognition, data thinking, and change leadership. A national sampling survey reveals that only 58.7% of midlevel managers in universities meet digital literacy standards, with significant deficiencies particularly in technical application skills (Source: Chinese University Science and Technology, 2024). The training system focuses on three types of courses: foundational courses covering practical skills like data visualization and RPA tool usage, requiring a minimum of 20 training hours per year; advanced courses teaching cutting-edge theories such as intelligent decision models and blockchain governance through case discussions and simulation exercises; and strategic courses centered on digital transformation strategy planning, inviting corporate executives and academic experts for cross disciplinary dialogues. The assessment mechanism incorporates digital literacy into annual evaluations for administrators; a pilot university in a province included data driven decision adoption rate (30% weight) and technology project promotion effectiveness (25% weight) as key evaluation indicators, resulting in a 45% increase in managers' willingness to adopt technology.

5.3 Ecological Construction: A Mechanism for Collaborative Evolution of "Technology People Institutions"

The core of ecological construction is to break the unidirectional influence model of technology, institutions, and individuals, forming a dynamically collaborative evolution system. At the technical level, a "demand driven" R&D mechanism is established, collecting technology improvement suggestions through a faculty and student demand survey platform; one university optimized its intelligent customer service system based on this, increasing problem resolution rates from 78% to 92% (Source: Modern Distance Education, 2024). At the institutional level, "agile governance" is promoted by forming rapid response teams for technology application, reducing the approval cycle for new system launch from 90 days to 30 days (Source: Chinese Higher Education, 2024). At the human resource level, a data culture is cultivated through activities such as

"Data Decision Pioneers" awards, fostering a participatory digital atmosphere. A typical case of synergistic collaboration is the renovation of a welcoming system at one university, which developed an intelligent welcoming robot based on feedback from faculty and students (technology), concurrently revised the "Student Affairs Processing Regulations" (institution), and organized specialized training for counselors (human resources), resulting in a 55% increase in welcoming efficiency and a 91% satisfaction rate for the process (Source: Field Survey Case Study, 2024).

5.4 Risk Prevention and Control: Data Security and Ethical Governance Framework

The risk prevention and control system include two modules: data security technology protection and ethical governance mechanism construction. For technical protection, a zero-trust architecture is employed to establish data security boundaries, deploying dynamic desensitization systems to obscure student privacy data; following implementation at one university, data breach incidents declined by 83% (Source: Big Data, 2024). Federated learning technology is utilized to facilitate cross university collaborative analysis while ensuring user privacy, thus enhancing data utilization efficiency (Source: Computer Application Research, 2024). For ethical governance, a university level technology ethics committee comprising legal experts, faculty and student representatives, and technical advisors is established to conduct preemptive reviews of the fairness and transparency of intelligent decision systems; an algorithm bias monitoring mechanism is set up, requiring that the group disparity for key applications like student evaluation systems and scholarship distribution models not exceed 5% (Source: Ethics and Education, 2024). Through dual assurances of technology and institutions, the incidence of data security events is controlled to under 0.3 per 10,000 users per year, and ethical risk complaints are reduced by 70%.

6. CONSTRUCTION OF SMART EDUCATION MANAGEMENT EFFECTIVENESS EVALUATION SYSTEM

6.1 Evaluation Model Design

An evaluation model consisting of four levels and 18 indicators is constructed based on maturity theory:

Basic Level: Completion of IoT infrastructure coverage (≥80%) and preliminary development of data platforms.

Integration Level: Achieving interdepartmental system connectivity (≥90%) and basic application of intelligent tools.

Intelligent Level: Normalization of data driven decision-making (data dependency ≥70%) and automation of governance processes.

Innovation Level: Establishment of a technology enabled ecosystem (collaborative projects with multiple stakeholders ≥5) and capability for model innovation outputs.

The indicator system encompasses three dimensions: technological empowerment (40%), management reform (35%), and service effectiveness (25%). Technological empowerment includes six secondary indicators such as infrastructure completeness and data governance maturity; management reform includes five indicators such as decision-making scientific city and governance collaboration; service effectiveness includes seven indicators such as student satisfaction and resource allocation efficiency.

6.2 Evaluation Method Selection

A hybrid evaluation method combining Structural Equation Modeling (SEM) and Fuzzy Comprehensive Evaluation (FCE) is employed. SEM verifies the impact pathways of technological empowerment on management effectiveness, revealing that data governance capability (β=0.421) and organizational adaptability (β=0.358) are key mediators in converting technology into effectiveness [study findings]. FCE addresses qualitative indicators by constructing a judgment matrix using a 19 scale to quantify fuzzy concepts like ecological collaboration and cultural acceptance. The evaluation process includes three stages: preparation (determining indicator weights), implementation (data collection and processing), and analysis (model computation and result interpretation), ensuring both scientific rigor and practical applicability.

6.3 Empirical Analysis and Result

Discussion

An empirical study involving 152 universities nationwide illustrates significant regional and hierarchical disparities in smart education management effectiveness: Eastern "Double First-class" universities average a maturity level of 3.21 (on a 4level scale) and have a data driven decision adoption rate of 78%; while Central and Western regional universities average a maturity level of 2.15, with a decision-making data dependency of only 45%. The disparity stems from the intensity of technological investment (Eastern universities' annual IT budget is 3.2 times that of Western universities) and the strength of institutional innovation (data governance committee coverage: 92% in the East vs. 48% in the West). Further analysis indicates an inverted U-shaped relationship between technological empowerment and management effectiveness, suggesting diminishing marginal returns when technological investment exceeds 15% of the annual budget, highlighting the need for universities to consider the alignment of technology and management.

7. CONCLUSION

This study constructs a theoretical framework and implementation system for technology enabled smart education management, revealing the intrinsic mechanism by which technological empowerment activates data elements, reshapes business processes, and reconstructs governance relationships to drive management transformation. The core characteristics of the smart education management model are the organic unity of data driven decision-making, intelligent collaborative governance, and personalized service provision, with effectiveness reliant on the collaborative evolution of technology application, institutional innovation, and personnel capabilities. The empirical research validates the effectiveness of the maturity assessment model and identifies key influencing factors behind regional and hierarchical differences.

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Innovative Applications and Practices of Virtual Reality Technology in Education

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Abstract: This study examines the innovative applications of Virtual Reality (VR) technology in education amid digital transformation. It addresses key challenges in traditional education, such as insufficient contextual creation and limited interaction. A theoretical framework, "Technology Empowerment Instructional Design Effectiveness Assessment," is constructed to guide the research. The analysis highlights VR's educational attributes, focusing on immersion, interactivity, and conceptualization, alongside dimensions of context construction, cognitive enhancement, and emotional engagement. A technology implementation framework comprising hardware, content, and instructional application is developed, emphasizing constructivist principles and a three-dimensional assessment index centered on learning engagement, knowledge retention, and emotional experience. Through a quasi-experimental design, the study compares VR instruction with traditional teaching across various subjects and learning stages. Results reveal that VR enhances classroom participation by 47% and improves understanding of complex concepts by 32%. The findings indicate that VR's educational effectiveness depends on device performance, content adaptability, and educators' technological proficiency. This research provides practical guidance for integrating VR technology in education, advocating for a shift from one-way knowledge transmission to immersive meaning construction.

Keywords: Virtual Reality Technology; Educational Applications; Immersive Learning; Instructional Design; Learning Outcomes

1. INTRODUCTION

1.1 Research Background and Technological Evolution

In the context of accelerated digital transformation in global education and the burgeoning development of metaverse technology, virtual reality (VR) is driving a paradigm shift from two-dimensional to three-dimensional educational contexts. According to IDC, VR education device shipments exceeded 12 million units in 2023, a 570% increase since 2019, with China accounting for 32% of the market. Key application scenarios include higher education experimental teaching, vocational skill training, and primary education scientific exploration. The "China Education Informatization Development Report" highlights VR's ability to create highly realistic virtual learning environments that transcend temporal and spatial limitations, showcasing advantages in visualizing complex principles and conducting practical simulations in hazardous scenarios.

On the technical front, advancements such as 5G network coverage exceeding 60% and the proliferation of lightweight devices (e.g., Pico 4, Meta Quest 3) have reduced VR system latency to below 15ms and expanded the field of view to 150 degrees, evolving from single controller interaction to multimodal input systems featuring eye tracking, gesture recognition, and haptic feedback gloves. However, current VR educational applications face challenges in the deep integration of technology and education, with only 41.2% teacher acceptance due to complex device operation, high content development costs (averaging over 50,000 RMB per lesson), and a lack of quantitative assessment systems.

1.2 Review of Domestic and International Research

Internationally, research began in the 1990s with a focus on "Virtual Labs" and functionality verification of technological

tools. With the emergence of embodied cognition theory, studies shifted toward analyzing learning mechanisms within VR environments, revealing that bodily interactions in VR can enhance spatial knowledge retention by 28%. Recent research has branched into two main areas: technology driven (e.g., MIT's VR chemistry molecular modeling system) and education adaptive (e.g., Cambridge University's VR language learning environment). However, existing studies commonly lack theoretical integration and systematic explanations of core value dimensions (e.g., emotional experience, social presence) in VR educational applications.

In China, research has rapidly developed since 2015, primarily focusing on application case development and effect comparison experiments. Studies from Beijing Normal University indicated a 35% improvement in the accuracy of understanding complex concepts in physics through VR simulation teaching. However, limitations include: 1) applications remaining at a "substitutive" level without a VR based instructional design theory; 2) assessment systems overly focusing on short-term outcomes, neglecting long term cognitive development and emotional attitude changes; 3) regional disparities, with VR classroom adoption rates of 27% in developed eastern regions compared to 8% in central and western regions. Overall, existing research has yet to establish a comprehensive logical chain linking "technology characteristics educational needs instructional innovation," particularly in foundational theory construction, technological framework optimization, and effect assessment system development.

1.3 Research Objectives and Innovative Value

This research aims to construct a systematic solution for VR educational applications, focusing on: 1) revealing learning cognition patterns in VR environments and establishing a theoretical model suitable for immersive teaching; 2) developing a technical framework encompassing hardware adaptation, content design, and instructional implementation to address the disconnect between technology and education; 3) creating a multidimensional assessment system covering cognitive effects, emotional experiences, and social interactions to provide a scientific basis for practical applications.

The innovative value lies in three aspects: 1) proposing a three-dimensional theoretical framework of "embodied cognition context construction social presence," transcending traditional tool based theories by analyzing VR's educational value from cognitive psychology and educational communication perspectives; 2) designing a VR content development model based on knowledge mapping, achieving semantic linkage between instructional content and virtual scenarios to improve knowledge presentation efficiency by 60%; 3) constructing a mixed assessment system incorporating physiological signals (eye movement trajectories, heart rate variability) and behavioral data (interaction frequency, task completion) to mitigate subjectivity in traditional assessment methods. These innovations will provide theoretical support and practical pathways for the deep integration of VR technology in education.

2. EDUCATIONAL THEORETICAL FOUNDATIONS OF VIRTUAL REALITY TECHNOLOGY

2.1 Cognitive Psychology Mechanisms of Immersive Learning

The core characteristic of VR environments lies in constructing embodied cognitive spaces through visual immersion (360degree scene rendering), interactive immersion (natural gesture operation), and psychological immersion (situational involvement). The embodied cognition theory posits that knowledge construction is achieved through interaction between the body and the environment. Neuroimaging studies show that bodily actions in VR activate a coordinated response between the brain's motor cortex and prefrontal cortex, improving the understanding efficiency of abstract concepts by 40%. For example, in teaching plate tectonics in geography, learners using gesture operations for virtual continental drift scored 25% higher in spatial reasoning tests compared to those using traditional animations.

Dual Coding Theory supports knowledge presentation in VR, suggesting that humans process information through both verbal and nonverbal systems (images, actions), and their

synergy enhances memory retention. VR technology converts abstract knowledge into three-dimensional visual models while allowing learners to interactively adjust parameters, resulting in deeper coupling of verbal and nonverbal representations, which has been shown to increase knowledge retention rates by 37%.

2.2 Adaptability of Constructivist Theory and Situational Learning Theory

Constructivism emphasizes learning as a process were learners, aided by others in specific contexts, construct meaning through necessary learning materials. VR technology creates ideal environments for meaning construction, allowing learners to autonomously design experimental plans in virtual labs and adjust their strategies based on real-time feedback, enhancing problem-solving abilities by 52%. Research from MIT indicates that inquiry-based learning in VR accelerates learners' metacognitive monitoring skills (planning, evaluation, adjustment) by 1.8 times.

Situational learning theory asserts that knowledge is context dependent and should unfold in authentic practical situations. VR can replicate complex scenarios difficult to recreate in reality, such as simulating street speeches during the May Fourth Movement in history classes, where learners participating as virtual characters experience a 65% increase in emotional resonance compared to text readings. This "immersive" learning breaks temporal and spatial constraints, facilitating the transfer of tacit knowledge (e.g., teamwork strategies, crisis response skills), particularly evident in vocational education and skills training.

2.3 Analysis of Core Value Dimensions in VR Educational Applications

From the essence of education, the core values of VR technology can be deconstructed into three dimensions:

(1) Context Construction Value: Creating physical simulations (e.g., celestial motion), process simulations (e.g., cell division), and social simulations (e.g., United Nations meetings) using tools such as Unity 3D and UE, addressing the paradox of "visible details without detail, and detail without visibility" in traditional teaching. A VR disassembly system developed by Beihang University improved students' understanding of internal structures from 38% using 2D diagrams to 89% in VR environments.

(2) Cognitive Promotion Value: Utilizing interactive devices for embodied knowledge operations, such as sensing object weight through haptic gloves (in physics) and focusing on key information through eye tracking (in medical imaging). Neurological experiments indicate that such multimodal interactions can enhance memory encoding efficiency in the hippocampus by 30%, and improve long-term memory retention by 22%.

(3) Emotional Engagement Value: The deep immersion of VR can trigger profound emotional experiences, such as simulating disaster rescue scenarios in moral education, where learners' empathy indices (measured by facial expression recognition metrics like frowning frequency and pupil dilation) improved by 47% compared to traditional video teaching. This emotional resonance offers new avenues for cultivating attitudes and values.

3. CONSTRUCTION OF THE TECHNICAL FRAMEWORK FOR VIRTUAL REALITY EDUCATION APPLICATIONS

3.1 Education Focused Design of the Hardware Ecosystem

The demand for VR hardware in educational contexts is unique, requiring a balance between immersive experiences and user convenience. Current mainstream devices fall into three categories:

PC VR (e.g., HTC Vive Pro): Offers high resolution (2448×2448 per eye) and low latency (90Hz refresh rate), ideal for complex professional training (e.g., mechanical design, medical simulation). However, mobility is limited due to cable connections, with classroom deployment costs ranging from 150,000 to 200,000 RMB per set.

Standalone VR (e.g., Pico 4 Enterprise): Lightweight (295g) and supports wireless streaming, with a battery life of up to 3 hours, suitable for K12 collective teaching. The device cost has decreased to 3,000 RMB per unit, with market share rising to 45% in recent years.

AR/Mixed Reality Devices (e.g., Microsoft HoloLens 2): Features environmental

mapping and gesture tracking, enabling the overlay of virtual objects on real scenes, particularly useful in engineering training for maintenance operations, with accuracy within a millimeter.

Key challenges in hardware adaptation include:

Motion Sickness Control: Optimizing head tracking accuracy (error <0.5°) and increasing display refresh rates (>120Hz) have reduced motion sickness incidence from 35% to below 8%.

Interaction Compatibility: Designing a universal interaction protocol tailored for educational scenarios to unify operational logic across devices.

Device Management: Developing remote monitoring systems to track realtime device status (battery, connectivity) and enhance classroom stability.

3.2 Knowledge Visualization Strategies in 3D Content Development

VR content development follows a technical route of "knowledge deconstruction scene modeling interaction design," focusing on translating subject knowledge into operable virtual objects.

Knowledge Deconstruction: Utilizing Bloom's taxonomy, content is categorized into factual knowledge (e.g., historical timelines), conceptual knowledge (e.g., mathematical sets), and procedural knowledge (e.g., chemistry experiments), each requiring distinct modeling strategies. For instance, procedural knowledge necessitates state machine models that include preconditions, action steps, and feedback mechanisms for logical closure in learner operations.

Scene Modeling: Tools like Blender and Substance Painter are employed to create high precision 3D models, emphasizing lighting (global illumination improves scene realism by 60%), physics simulation (realistic collision feedback), and particle systems (simulating dynamic effects like fluid and fire). A VR quantum physics course developed by the University of Science and Technology of China utilized ray tracing to illustrate photon trajectories, reducing the difficulty of understanding abstract theories by 40%.

Interaction Design: Prioritizing "natural interaction," various methods such as gesture controls (e.g., grab, drag), voice commands (e.g., "zoom in on the molecular structure"), and gaze selection (triggering interactions by focusing on an object for 2 seconds) are implemented to reduce cognitive load. Eye tracking experiments indicate that appropriate interaction designs can enhance operational efficiency by 55% and lower error rates by 38%.

A quality standard system for content development must include critical indicators such as model precision (≤500,000 triangles), interaction response time (≤200ms), and cognitive load index (quantified by changes in pupil diameter, threshold ≤0.65) to ensure educational applicability.

3.3 Integration of Multimodal Interaction Technologies in Educational Scenarios

Multimodal interaction technologies integrate various sensory inputs (visual, auditory, haptic) to establish a comprehensive learning interaction system.

Gesture Recognition Technology: Utilizing Leap Motion sensors for precise five-finger motion capture, supporting complex tasks (e.g., titration in chemistry) with an accuracy rate of 92%. In biological anatomy teaching, learners demonstrated a 70% improvement in detail handling over traditional mouse-based operations.

Voice Interaction Technology: Combining natural language processing (NLP) for intelligent Q&A, enabling real-time retrieval from knowledge bases. For example, in a VR history class, when a learner asked about the "direct cause of the May Fourth Movement," the system could generate a 3D scene based response (showing the Paris Peace Conference model plus voice explanation) with a response delay of ≤500ms.

Physiological Signal Feedback: Collecting learner data (stress and focus levels) through sensors, dynamically adjusting scene difficulty. For instance, if a learner's heart rate exceeds 120 bpm, the complexity of virtual experiments is automatically reduced, leading to a 25% decrease in anxiety levels.

Different teaching scenarios have varying needs for interaction technologies: knowledge explanation scenarios emphasize voice and gaze interactions, experimental operations rely on gestures and force feedback, while collaborative learning needs embodiment expression and action synchronization.

Research from Beijing Normal University indicates that a well combined multimodal interaction can increase learner engagement by 63% and reduce cognitive load by 28%.

4. DESIGN OF INNOVATIVE TEACHING MODELS BASED ON VR

4.1 Principles for Designing Immersive Situations

Creating immersive situations requires adherence to three core principles to achieve deep coupling between educational goals and technological characteristics.

Realism Principle: Ensures virtual scenes align with real world physical laws and social logic through precise modeling using Unity's physics simulation system. For example, in mechanical engineering classes, the precision of torque feedback in VR machine operations is 0.1 Nm, with mechanical feedback on part assembly errors below 5%, enhancing skill transfer efficiency by 62%.

Task Driven Principle: Focuses on designing learning tasks based on real problems, transforming educational objectives into actionable virtual activities. In medical education, a "virtual emergency room" scenario requires learners to diagnose injuries and devise surgical plans within a time limit, shortening the formation cycle of clinical decision-making skills by 38%.

Interaction Generation Principle: Emphasizes dynamic interaction between learners and the virtual environment or peers to promote knowledge construction. For instance, in history courses, interactive virtual characters (e.g., student representatives from the May Fourth Movement) generate dialogues based on learner choices, improving historical understanding depth by 45% compared to traditional lectures.

4.2 Workflow of Task Driven Learning Activities

Task driven activities construct a three-dimensional workflow of "situation introduction exploration and practice reflection and construction."

Situation Introduction: Utilizing 360degree panorama videos and environmental sound effects to create immersive initial experiences. For example, in geography classes showing a volcanic eruption, simulating ground vibrations increases learner attentiveness to 89% within 3 seconds.

Exploration and Practice: Offering multiple operational paths, learners interact with virtual objects using gesture dragging and voice commands, with the system tracking operational trajectories to generate behavior logs. In chemistry labs, allowing learners to choose reagent addition sequences leads to an increase in accurate understanding of experimental principles from 61% to 87%.

Reflection and Construction: Employing virtual whiteboards and mind mapping tools for knowledge visualization, personalized feedback is provided based on real-time monitoring data (e.g., operation time, key step completion). Empirical studies show that this process increases the frequency of metacognitive strategy use by 2.3 times and innovative problem-solving scores by 31%.

4.3 Teacher Student Interaction Mechanisms in Mixed Reality Environments

Teacher Role Transformation: Evolving from knowledge transmitters to meaning construction guides, teachers can monitor learners' physiological data (heart rate, gaze hotspots) and operational logs in real-time, enabling targeted interventions. For instance, if a student repeatedly encounters a short circuit error in virtual circuit connections while showing heightened heart rates, the teacher can remotely send instructional video prompts, improving error correction efficiency by 40%.

Intelligent System Assistance: Utilizing NLP for real-time Q&A, a reasoning engine based on knowledge graphs can identify deep learner needs (e.g., translating "How to calculate resistance" into "Application of Ohm's Law in series circuits") and retrieve corresponding 3D dynamic models for visual explanations with an accuracy rate of 91%.

Student Centered Interactions: Facilitated by virtual avatars for collaborative learning, supporting gestures and item sharing in multiparton screen scenarios. In team based virtual architectural design tasks, the frequency of effective communication among members rose by 55% compared to traditional online collaborations, while solution iteration efficiency improved by 42%.

5. ASSESSMENT SYSTEM FOR VR

EDUCATIONAL EFFECTS

5.1 Multidimensional Evaluation Indicators for Learning Outcomes

A three-dimensional evaluation system encompassing cognitive, emotional, and social interaction dimensions is established to comprehensively reflect VR educational efficacy.

Cognitive Dimension: Indicators include knowledge retention rate (measured by spaced repetition tests over 30 days), problem-solving speed (time taken for complex tasks), and spatial reasoning ability (accuracy in 3D object rotation). Experiments show a 29% higher knowledge retention rate and a 36% improvement in spatial reasoning accuracy for the VR group compared to traditional groups.

Emotional Dimension: Quantified through physiological signals and behavioral observations, including pupil dilation (indicating attention), facial micro expressions (detecting emotional fluctuations), and active exploration duration (reflecting learning interest). In VR environments, the average active exploration duration is 28 minutes per class, 3.2 times longer than traditional classrooms.

Social Interaction Dimension: Examines collaborative task completion quality (team project scoring), avatar interaction frequency (gesture/voice exchanges in virtual settings), and social presence (assessed through a 5point presence scale). Data indicates that VR collaborative learning yields a 41% improvement in team task quality compared to online meeting tools.

5.2 Quantitative Assessment Methods and Data Collection Technologies

Quantitative evaluations integrate multisource data collection technologies for precise measurement.

Behavioral Data Collection: VR device sensors record head movement trajectories and controller force, combined with learning management system logs, creating operational behavior feature vectors (with 87 dimensions), effectively predicting learners' knowledge mastery (accuracy rate of 82%).

Physiological Data Collection: Eye tracking technology monitors visual attention distribution (accuracy 0.5°), while heart rate monitors track emotional fluctuations (sampling frequency 1Hz). When learners spend over 60% of their gaze on key knowledge points and maintain a heart rate of 6080 bpm, their depth of understanding significantly exceeds control conditions.

Learning Outcome Data: Dynamic capability level assessment is performed through Computerized Adaptive Testing (CAT). The VR teaching group shows a 0.15 lower standard error in CAT testing compared to traditional groups, indicating higher assessment precision.

5.3 Qualitative Research Framework for Learner Experience

Qualitative research employs phenomenological interviews and grounded theory coding to analyze deep learning experiences.

InDepth Interviews: Structured around themes of "immersion," "interaction experience," and "cognitive challenges," interviews with 200 VR course learners revealed that 83% felt that the realism of virtual operations significantly enhanced their learning engagement, with 67% noting that the improvement in spatial interaction abilities exceeded their expectations.

Focus Groups: Concentrating on teaching design improvements, learners highlighted the intelligence level of virtual characters (42%), scene transition smoothness (35%), and error feedback formats (23%) as their main concerns; recommendations have been applied to optimize course interaction design.

Discourse Analysis: Using NVivo software to code interview texts, a core experiential path of "embodied cognition situational immersion meaning construction" was extracted, revealing the role of bodily participation in enhancing understanding of abstract knowledge in VR learning.

6. PRACTICAL CHALLENGES AND DEVELOPMENT PATHWAYS

6.1 Analysis of RealWorld Constraints in Technology Application

The promotion of VR education faces three practical challenges:

Incomplete Hardware Ecosystem: Despite standalone device costs dropping below 3,000 RMB, the prices of complementary peripherals such as interactive gloves and force feedback vests remain high (8,000 RMB per set), making comprehensive solutions for

vocational training scenarios exceed 500,000 RMB per classroom, thus limiting widespread adoption.

High Barriers to Content Development: Developing high-quality VR courses takes 812 weeks per lesson, requiring collaboration among subject experts, 3D modelers, and software engineers, with labor costs accounting for over 70%, leading to insufficient supply of quality resources.

Significant Teacher Capability Gap: Surveys indicate that only 23.7% of teachers possess VR teaching design skills, with 41.2% experiencing difficulties operating equipment. The traditional teacher education system lacks systematic training for immersive technology applications.

6.2 Collaborative Optimization Strategies for "Technology Teaching Management"

Developing a three-dimensional collaborative mechanism to address application bottlenecks.

Technological: Promoting lightweight development tool accessibility, such as the "VR Education Creation Platform" spearheaded by the Ministry of Education, which reduces modeling difficulties by 60% and includes a material library with over 3,000 standardized models across 12 disciplines, shortening the course development cycle to 2 weeks per lesson.

Teaching: Establishing a "dual teacher collaboration" model, where subject teachers design learning objectives while technical assistants manage equipment operation and interaction guidance. Pilot practices in some schools show a 35% increase in effective teaching time and a 58% decrease in teachers' technology anxiety.

Management: Enhancing policy support frameworks, Beijing has issued the "VR Educational Equipment Configuration Standards," stipulating a minimum investment of 500 RMB per student, while establishing a quality course resource sharing platform, achieving a regional content circulation rate of 40%.

6.3 Future Trends in Educational Development

With technological iterations and educational demands upgrading, three major trends in VR education are emerging:

Full Scene Integration Trends: Shifting from single classroom applications to a full cycle support model of "immersive learning in class lightweight experiences out of class," such as the integration of AR glasses to overlay virtual knowledge on real campus scenes, expanding learning environments to libraries and laboratories.

Intelligent Upgrade Trends: Integrating generative AI for dynamic content adaptation, automatically adjusting virtual scene difficulties and interaction methods based on learners' real-time physiological data and operational logs, forming an intelligent feedback loop of perception, decision-making, and response.

Social Collaboration Trends: Building a VR educational community where enterprises provide technical support (e.g., Meta's Education VR program), universities focus on theoretical development, and primary and secondary schools conduct practical validations, fostering positive interactions between technological innovation and educational applications.

In the future, as metaverse technologies mature, VR education is expected to evolve from an auxiliary tool to a core teaching modality, advancing education towards the ultimate goals of "embodied cognition, immersive collaboration, and personalized development."

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On the management of Zhoucun commercial port from the perspective of the Analects of Confucius

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Abstract: As the birthplace of Lu merchants, Zhoucun commercial port has rich cultural connotations in its successful business model and philosophy. As a classic of Chinese traditional Confucian culture, the Analects of Confucius has a far-reaching impact on commercial management. Through the analysis of historical data and related research, this paper aims to explore the way of operation and management of Zhoucun commercial port from the perspective of the Analects of Confucius, and reveal the internal influence and reasons of the thoughts and ideas of the Analects of Confucius on the development of Zhoucun commercial port.

Keywords: The Analects of Confucius; Zhoucun commercial port; The way of management

1. RESEARCH BACKGROUND AND SIGNIFICANCE

The Analects of Confucius, a quotation carrying Confucius' main thoughts, covers a wide range of contents, which makes the cultural heritage of the Chinese nation have profound connotations and has influenced all aspects of human society so far. Zhaopu, a politician in the Northern Song Dynasty, once commented on the Analects of Confucius: "half the Analects governs the world", which has been widely spread by later generations, showing that the Analects of Confucius has a far-reaching impact on management.

Due to its unique history, region, business inheritance, cultural integration and other special attributes, Zhoucun commercial port has become the birthplace of Lu merchants, inheriting the spirit of Lu merchants of "kindness, integrity, openness and inclusiveness", and creating the prosperous scene of "during the reign of Emperor Kangxi and the reign of Emperor Yihai, Zhoucun merchants gathered in Zhoucun, taking advantage of the ruins, and cars and horses were scattered". When Emperor Qianlong passed by Zhoucun, he was surprised at the prosperous trade here and praised it as "the first village in the world".

Combining the thought of the Analects of Confucius with the management of Zhoucun commercial port will not only help to excavate the cultural heritage and influence associated between the thought of the Analects of Confucius and Zhoucun commercial port, carry forward the charm of the Analects of Confucius, absorb the essence of management from the excellent traditional culture, and establish the belief of "cultural confidence"; It will also help inject the ideological value of the Analects into the contemporary social system, root the management ideas extracted from the excellent traditional culture in the fertile soil of practice, guide and promote the development of contemporary economy, and enhance the application value of the Analects.

2. THE MANAGEMENT CONCEPT IN THE ANALECTS OF CONFUCIUS

2.1 Integrity based

Honesty is the foundation of life and the way of communication. Confucius believed that honesty is the most basic quality of a person, the foundation of a society and the criterion for communicating with others. In the Analects of Confucius, for politics, it is mentioned that "people have no faith, so I don't know what it can do". Zizhang once asked Confucius how to improve his personal moral cultivation. Confucius replied that "loyalty, righteousness, and virtue" (from the Analects of Confucius, Yan Yuan). It means that with loyalty and faithfulness as the purpose of life and following morality, we can improve our moral character. "When making

friends, keep your word" (from the Analects of Confucius Xueer). When communicating with friends, you should be trustworthy and do what you say. Confucius' own pursuit of life is also to achieve the realm of "the old should be at ease, friends should believe it, and the young should cherish it" (from the Analects of Confucius · gongyechang).

Integrity is the foundation of a career. "A gentleman is compared to righteousness and a villain is compared to profit" (from the Analects of Confucius. Liren). Confucius has always advocated valuing justice over profit, but he is not opposed to obtaining economic benefits, but emphasizes the correct way, that is, to obtain personal benefits in accordance with "morality". Honesty and trustworthiness is one of the important standards of "morality". "Faithfulness is close to righteousness, and words can be repeated" (from the Analects of Confucius · Xueer). This sentence emphasizes the relationship between honesty and morality. Only when our commitments are in line with the principles of morality and rationality, such commitments are valuable and can be truly fulfilled and realized.

Honesty lies in practicing. Confucius attached great importance to the practice of honesty, and believed that honesty should be based on the unity of knowledge and practice. "Keep your word and act accordingly" (from the Analects of Confucius. Zilu), "keep your word" means you should keep your word, "act accordingly" means you should act decisively to fulfill your promise, emphasizing that people should fulfill their promises instead of just saying nothing.

2.2 The debate between righteousness and benefit

The argument between righteousness and benefit is an important topic in Chinese philosophy, which is deeply discussed in the Analects of Confucius. "Yi" in the Analects of Confucius usually refers to moral norms and morality, which is the principle of behavior in line with social ethics and moral norms; "Benefit" mainly refers to material benefits, benefits, utilitarianism, etc.

The Analects of Confucius · constitutional questions has such a description of the "view of justice and benefit": "thinking of justice in the light of profit", which advocates that when facing interests, you should first consider whether it is in line with morality, and if it is in line with morality, it is acceptable, otherwise it should not be taken as your own. When pursuing personal interests, the principles of morality and justice should not be ignored. Otherwise, even if benefits are obtained, they will not be recognized by others and society. It is the so-called "justice is followed by taking, and people are not tired of taking. " Confucius laid the foundation for the "discrimination between justice and benefit". His proposition of "gentlemen are compared with justice, and villains are compared with benefit" also explains the difference between gentlemen and villains in the treatment of justice and benefit. Gentlemen take "justice" as the rule of conduct, while villains take benefit as the rule of conduct. When pursuing commercial interests, they should also follow the code of ethics, not take ill gotten money, and stick to the bottom line of business.

2.3 Harmony is precious

"Harmonious management thought" has been running through the Analects of Confucius and occupies an important position in Confucianism as a way of management. In the Analects of Confucius Xueer, the saying that "harmony is the most important use of etiquette" emphasizes the use of etiquette and harmony is the most important. the "harmony" here refers to the coordination and harmony between people under the norms of etiquette. People follow the norms of etiquette, respect and tolerate each other, so as to create a harmonious atmosphere. the saying of "harmony generates wealth" often mentioned by modern people also comes from this. In business activities, both parties to the transaction adhere to the idea of "the use of etiquette, harmony is precious", communicate and negotiate in a polite and respectful manner, follow certain business rules and moral standards, and reach a harmonious trading atmosphere. This harmonious attitude and atmosphere will ultimately promote the success of the transaction and bring economic benefits to both parties.

2.4 Learn from time to time

The Analects of Confucius contains a lot of rich ideas about learning and practical innovation. the familiar "learning and learning from time to time, isn't that right?" from the Analects of Confucius, learning, warns that

learning is a dynamic process, "learning" is a process of cognition, "learning" is a process of consolidation, "learning" and "learning" should be unified. We should not only "learn" theories and thoughts, but also "learn from time to time", that is, we should put what we have learned into practice. "Reviewing the old and knowing the new can serve as a teacher" (from the Analects of Confucius for politics), which reflects that people can obtain new understanding and experience in the process of reviewing old knowledge. Learning is not a simple repetition, but an in-depth reflection and re-examination of existing knowledge to discover new insights and innovations. "When three people walk together, there must be a teacher" (from the Analects of Confucius · Shuer), and "being sensitive and eager to learn and not ashamed to ask questions" (from the Analects of Confucius · gongyechang) convey Confucius' open learning attitude, asking others for advice with an open mind, learning from experience and lessons, and constantly improving himself.

In operation and management, managers should be good at listening to the opinions and suggestions of their subordinates (not ashamed to ask questions from below), learn from others' excellent management experience (there must be a teacher for three people), and constantly learn and update operation and management concepts and methods in management practice (learn from the times, review the past and know the new), so that enterprises can show vitality in the changing market and continue to grow.

3. THE INFLUENCE OF THE THOUGHT OF THE ANALECTS OF CONFUCIUS ON THE MANAGEMENT OF ZHOUCUN COMMERCIAL PORT

3.1 The rise and development of Zhoucun commercial port

Zhoucun, formerly known as Yuling city of the state of Qi, has been an important silk textile center since the Shang Dynasty, and the variety of commodity transactions has increased since the Ming Dynasty. At the beginning of the Qing Dynasty, lihuaxi resigned and returned home, establishing the first "tax free zone" in Chinese history in Zhoucun, attracting businessmen from all over the country to open stores and do business, gradually forming a nationally famous commercial town. During the reign of Emperor Qianlong of the Qing Dynasty, Zhoucun was granted the title of "the first village in the world". In the middle of the Qing Dynasty, the Meng family headed by Meng Luochuan successively set up eight "auspicious" brands here, of which "Wan fuxiang" was the predecessor of "Rui fuxiang" which became famous in later generations. In the same period, more than 80 banks and banks were set up, together with more than 10 ticket banks opened by Shanxi businessman qiaozhiyong in Zhoucun, which facilitated the exchange of payment for goods between the town and foreign firms.

In 1904, the Jiaotong Jinan railway was opened to traffic, and Zhoucun, Jinan and Weixian were opened as commercial ports by the Qing government at the same time. At this time, Zhoucun had nearly 2000 shops, "earning a lot of money every day", and had the reputation of "dry wharf". Before and after the opening of Zhoucun, there were four major mechanical silk reeling factories, hengxingde, yuhoutang, Tongfeng and Yuanfeng, which were the earliest and largest modern enterprises in northern China. Chenshouting, a big industrialist in the printing and dyeing industry, and the illiterate chenliting (the prototype is chenliting) and his big dye shop started in Zhoucun. In the late period of the Republic of China, affected by war, corruption of officials and the transfer of trade routes, Zhoucun commercial port declined gradually.

3.2 The profound influence of the thought of the Analects of Confucius on the management of Zhoucun commercial port

3.2.1Classic cases of honest management

At the beginning of the establishment of Zhoucun, Rui fuxiang established the business tenet of "sincerity first, truth at a reasonable price, words at a reasonable price, and no deception between the old and the young". Mengluochuan, the owner of the company, designed a special ruler, which is one inch longer than the standard city ruler and is called "conscience ruler" by the common people. Before the shop assistants go to the counter every day, the shopkeeper always admonishes them: "when you go to the counter, the ruler in your hand is engraved with heaven and earth,

filial piety, fraternity, loyalty, faith, etiquette, righteousness, honesty and shame, and the conscience of heaven and earth and eight ethics and eight virtues are integrated into one foot. What you hold in your hand is the conscience of heaven and earth. " although it seems that every foot of cloth merchant has lost an inch, in fact, every foot has earned an inch of conscience. If you give an inch more to your guests today, your reputation will increase by one point tomorrow. With this integrity management concept, Rui Fuxiang's business in Zhoucun and many places in the country can develop for a long time.

There is still a stele and a stone in the middle of Zhoucun street, which is engraved with the words "return the gold". the stone inscription reads: "zhaoyunheng, a native of Baoshui village, trades in silk, is suitable for Zhoucun town in Changshan, near the city, and picks up 200 pieces of gold. So he waited on the roadside, and stayed hungry from the day until noon. Suddenly, a person came, looked around in a hurry, cried out to heaven, asked him, that is, the person who left the gold, asked him the number, the result, and then paid him. He was firm and shared, saying, 'it is better to get half of it than get it. ' he was not satisfied with his words, but he was very sensitive. He asked his name, and didn't tell him. After reading it for half a year, the man stood on the stone and wrote a big book 'return the gold'. " (from Zichuan county's "thick chapter of three continuations of righteousness"), it can be seen that honesty and trustworthiness became a common practice in the area of Zhoucun commercial port at that time, and became a symbol of the spirit of honesty in the thought of the Analects. This wordless monument, It encourages generations of businessmen and local people to uphold good moral quality, maintain good folk customs and an orderly business environment.

Zhoucun commercial port management is deeply baptized by the Confucian classic "the Analects of Confucius", adhering to the Confucian self-discipline and being faithful to the Confucian moral norms. Whether it is the unique business purpose of Ruifuxiang or the appearance of the stone tablet of "returning gold", it shows that the merchants of the commercial port establish a trading relationship based on integrity with their partners in business activities, and regard reputation as the life of the enterprise. the shops in Zhoucun commercial port, which can penetrate the history and retain the style, are the best proof.

3.2.2The successful practice of the balance of justice and benefit

In the commercial legend of Zhoucun commercial port, qianxiangyi silk shop is also influential. At the time of its opening, the undercurrent of commercial competition surged. Some peers sent people to help and deliberately increased the size of the shop in an attempt to make qianxiangyi lose money due to increased costs in this commercial debut, but unexpectedly brought unexpected publicity effects to qianxiangyi. the story of "qianxiangyi increases the size of the shop, but not the price" quickly spread in the streets of Zhoucun commercial port. When customers heard about this, they marveled at qianxiangyi's atmosphere and benevolence. For a time, qianxiangyi's business became more and more prosperous. the shopkeeper of Qian Xiangyi knew that commercial operation should not only focus on private interests, but also take into account social responsibilities and actively participate in local public welfare undertakings. In the year of famine, Qian Xiangyi took the initiative to open warehouses and release grain to relieve the victims; Invested in the repair of roads, bridges and other infrastructure in Zhoucun village. These righteous deeds have enhanced the prestige of Qian Xiangyi in the hearts of the people. With the business model of giving consideration to both justice and profit, Qian Xiangyi has a firm foothold in Zhoucun commercial port, and gradually expanded to other regions, becoming a famous silk cloth firm in the north. During the gengzi revolution in 1900, Shandong ruifuxiang's branch in Dashilan was reduced to ashes, and all accounts and items in the store were burned. As soon as the fire was extinguished, mengluochuan, the leader of ruifuxiang, was the first to announce the resumption of business on the ruins and put up a notice: "all the money owed by our store to customers will be returned, and all the money owed by customers to our store will be written off, and our store will never close!" mengluochuan's loss after loss attracted the discussion of surrounding customers.

Mengluochuan, who took the initiative to benefit customers, soon got unexpected results - all the customers who owed ruifuxiang money were grateful, introduced their relatives and friends to ruifuxiang to do business, and became loyal customers of ruifuxiang. Mengluochuan summarized this as "big business has no calculation" - the grand business way stresses business values, and does not plan how to cheat and rob while the fire is burning. Putting "righteousness" above "benefit" and focusing on integrity and morality, it has not only safeguarded the interests of customers, but also won widespread praise and trust from the society, laying a solid foundation for the long-term development of the brand.

"A gentleman is compared to righteousness, and a villain is compared to profit". Businessmen can take into account morality and justice while pursuing commercial interests. When there is a conflict between righteousness and profit, they can reasonably balance the relationship between righteousness and profit, and stick to the bottom line of business from the perspective of long-term development. For more than 1000 years, although the dynasties have changed and the world has changed, the business culture and Confucian culture, which were bred in Qilu, have converged and merged in Zhoucun, nourishing this land.

3.2.3Building a harmonious business environment

Since the opening of Zhoucun in 1904, businessmen from all over the country have gone to the ravines, and foreign-funded enterprises have also settled in one after another. the chamber of Commerce has played an important role in maintaining normal market order. All previous presidents and members of the chamber of commerce were persons with knowledge, rich business experience and high prestige in the commercial port. the chamber of commerce is responsible for formulating industry norms and self-discipline standards, requiring all members of the commercial port to strictly abide by them to ensure fair competition, and the chamber of commerce takes the lead in organizing merchants to jointly deal with external competition and promote cooperation and unity among merchants. In the face of market risks and fluctuations, the chamber of Commerce coordinates and organizes businesses to negotiate and jointly formulate coping strategies to avoid vicious competition within businesses. While protecting the interests of old members, the chamber of commerce also actively supports new members. the chamber of Commerce in Zhoucun commercial port has played an important role in coordinating business relations and resolving business disputes, creating a harmonious and prosperous business environment and promoting long-term and stable development.

Mengluochuan has formulated strict rules and regulations on hospitality, requiring employees to treat customers with humility and patience, and provide warm and thoughtful service. As long as the guests who enter the gate of ruifuxiang, whether shopping or not, are warmly welcomed, and no matter how picky the customers are, the clerks should be patient to serve customers to their satisfaction. In the year of unstable prices, if customers buy the same cloth again, but the price has risen, ruifuxiang would rather lose money and sell it to customers at the original price to satisfy the old customers. While being strict with employees, Rui Fuxiang also provides better employee benefits than stores in the same industry, making employees feel that "work pays off ". Rui Fuxiang has changed the traditional employment relationship. the responsibilities of the owner (Investor) and the shopkeeper (professional manager) are separated. Employees must enter into contracts, classify grades and income standards, regularly inspect promotions, and senior staff can share shares with the owner and enjoy dividends when due. This new employment system makes the whole firm share weal and woe and feel the same. In addition to being good at doing business, the merchants of the Meng family are also enthusiastic about charity and education activities. They have helped the imperial court to donate money for disaster relief many times. They not only took the lead, but also called on the merchants in the commercial port to spare no effort to hoard grain for famine and raise food for relief. They were praised by the imperial court and have a reputation for running education in their hometown.

In Confucianism, it emphasizes the cooperation and harmony between people, people and organizations, organizations and organizations, and within organizations. "Harmony is precious" stresses the harmony of heaven, humanity, and man and nature. It is through understanding the true meaning of "harmony" that Meng businessmen can maintain a harmonious state in their business activities.

3.2.4Learning innovation promotes development

The boss of "big dye shop" - chenshouting, who grew up from a beggar to a national entrepreneur, although illiterate, asks lujiaju to read newspapers for him every day, understand the political and economic situation, master the new trends and technologies of the industry, and use them to guide his business activities. This is to "learn from the times". When Zhoucun started his business, he optimized the grey cloth before dyeing, so that the quality of the same grey cloth dyed in his dyeing shop was better than that of others. On the basis of the traditional dyeing process, he improved the dye formula, dyeing process, temperature control and other aspects, realizing "reviewing the old and learning the new", making the dyed cloth brighter and more durable, controlling the cost and attracting a large number of customers. When competing with the Lin family in Shanghai, he poached some of the Lin family's senior technicians in Shanghai with high salaries, obtained new dyeing and weaving technology, and then innovated in the pattern, introduced a series of novel styles and colors, enhanced his competitiveness, and practiced the "three people walk, there must be my teacher".

Qiaozhiyong, who had been studying hard since he was a child and was bent on taking an official career, was ordered to shoulder the heavy burden of his family's business in the face of danger. Since he has never been involved in business, the whole family and shareholders are skeptical of him, "knowledge is power". Qiaozhiyong, who has read a lot of poetry and books, soon took office, and soon proved his personal ability with facts to shut up all the skeptics. the prosperity of commercial ports gave birth to ticket banks. As a farsighted Shanxi Merchant, qiaozhiyong keenly saw this market, changed the name of "dadexing" to "dadetong", shifted the original main business to the ticket industry, and put forward the grand goal of "connecting the world". Since then, Qiaojia ticket bank has gradually expanded to the main commercial ports and terminals in the country, including the dadetong ticket Bank of Zhoucun commercial port. From a scholar to a successful businessman, it is the accumulation of knowledge and practice over the years that makes qiaozhiyong have foresight. His insight into market changes makes him constantly innovate and improve the ticket business model, which not only makes "dadetong" stand out from the 108 larger ticket stores in Zhoucun commercial port, but also becomes the largest ticket store in the Qing Dynasty at its peak.

4. EXPLORING THE CAUSES OF THE INFLUENCE OF THE THOUGHT OF THE ANALECTS OF CONFUCIUS ON THE MANAGEMENT OF ZHOUCUN COMMERCIAL PORT

As the birthplace of Lu merchants, Zhoucun inherits the spirit of Lu merchants of "kindness, integrity, openness and inclusiveness", which is highly consistent with the core idea advocated in the Analects of Confucius. the reason why the business operation and development of Zhoucun commercial port are deeply influenced by the Analects of Confucius is mainly due to the following reasons:

Cultural heritage. Zhoucun is located in the land of Qilu and deeply infiltrated by Confucian culture. the thought of the Analects of Confucius has a deep cultural foundation and a wide range of social identity. From personal cultivation to family harmony, to social governance and national stability, all are influenced and guided by Confucianism. Under the influence of this cultural inheritance, the thoughts and ideas of the Analects of Confucius will naturally penetrate into the commercial operation and management of Zhoucun commercial port. Zhoucun commercial port not only pays attention to economic benefits, but also pays more attention to humanistic care and social responsibility in commercial activities.

Ethical and moral constraints. In the

traditional feudal society, there are not many corresponding systems to regulate business behavior. Ethics and morality play a very important role in replacing the missing system in business activities and have strong constraints on people's behavior. Since ancient times, businesses have paid special attention to reputation. Businesses without reputation cannot stand and develop for a long time. In the process of operation, the merchants of Zhoucun commercial port pay attention to business ethics and adhere to integrity management, which is the only way to create this glorious historical period. the moral code and code of conduct proposed in the Analects of Confucius conformed to people's cognition at that time and was widely recognized.

Driven by social environment. In the traditional commercial society, the values advocated by Confucianism are respected. Following the ethics and code of conduct in the Analects of Confucius can be respected and praised by the society. In order to establish a good image and harmonious contacts, win the support of court officials, customers, partners and other parties, and strive for more business development opportunities, the merchants of Zhoucun commercial port will actively apply the thought of the Analects of Confucius to the practice of business activities.

Long term benefit pursuit. In the historical development of the commercial port, although there have been a few businessmen who have taken some unfair means of competition in order to seek their own short-term interests, in the long run, the shops that can survive and develop in the long river of history and are well-known, and even become "time-honored brands in China" are all based on the management idea of the Analects of Confucius to establish a stable customer group and establish a good brand image, so as to realize the sustainable development of Commerce. While benefiting from it, the older generation of businessmen also pass on the business philosophy and experience based on the Analects of Confucius to the younger generation, so that they can deeply learn and understand the wisdom of the Analects from childhood, so that these thoughts and experiences can be passed on from generation to generation in the family, laying a solid foundation for future business operations and forming a unique business culture.

PROJECT OF THE SUBJECT

Key Project of Art and Science in Shandong Province: Research on the Commercial Operations of Zhoucun Commercial Port from the Perspective of the Analects (Number: 24ZZ20016624).

Special Project of “Traditional Culture and Economic and Social Development” in Shandong Province: Research on the Connotation, Characteristics, Inheritance and Development of Lu Shang Culture (Number: 24C120017779).

Key Project of Art and Science in Shandong Province: the influence of Lu Shang culture on Accounting Culture——Based on the dual perspectives of tradition and Modernity (Number: 25ZZ20022813).

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A Brief Analysis of the Empowerment Path of Financial Technology for the Development of Qi Culture in the Digital Economy Era

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Abstract: In the context of the digital economy, financial technology (FinTech) has provided new momentum for the digital transformation of regional traditional culture through technological empowerment and innovative models. Taking Qi Culture as the research subject, this paper explores how FinTech can facilitate its digital inheritance and industrial development. By analyzing application scenarios of technologies such as blockchain, digital payments, and crowdfunding, combined with case studies of digitalization projects in traditional Qi Culture, a converged model of "technology + culture + finance" is proposed, along with specific implementation pathways. The research indicates that FinTech can address issues such as low dissemination efficiency and weak industrialization capacity in Qi Culture, while cautioning against the potential erosion of cultural authenticity due to technological alienation.

Keywords: Financial Technology; Qi Culture; Pathways; Impact

1.INTRODUCTION

As a vital source of Chinese civilization, Qi Culture exhibited distinctive cultural traits as early as the pre-Qin period. The core essence of this regional culture is manifested in three key aspects: first, a transformative consciousness characterized by "respecting the worthy, valuing merit, facilitating commerce, and benefiting craftsmanship"; second, an inclusive attitude epitomized by the "contention of a hundred schools of thought at the Jixia Academy"; and third, a pragmatic approach emphasizing "adaptation to local conditions and pursuit of practical results." In terms of tangible cultural heritage, historical relics such as the ancient city ruins of Linzi (capital of the Qi State), bronze artifacts housed in museums, and the internationally recognized sport of Cuju (ancient Chinese football) serve as important testaments to its legacy. The intangible cultural heritage includes traditional crafts like Lu-style interior-painted snuff bottles and Zhoucun sesame seed cake-making techniques, as well as folk ballads, proverbs, and other oral traditions. With the advent of the digital age, the preservation and transmission of these cultural resources face new challenges, necessitating innovative approaches to inheritance enabled by digital technologies.

Advances in modern financial technology have opened new pathways for revitalizing traditional culture. Innovations in payment technologies facilitate novel cultural consumption models, blockchain applications enable digital authentication of cultural heritage, and big data analytics provide precise insights into cultural market demands. These technological solutions not only address practical challenges in cultural preservation—such as funding shortages and limited dissemination—but also drive the digital transformation of cultural industries. For regionally distinctive cultural forms like Qi Culture, FinTech can integrate digital preservation, dynamic dissemination, and market-oriented development of cultural resources, offering fresh perspectives for local cultural innovation. This development model, which synergizes technology, culture, and finance, is emerging as an effective approach to resolving the modern transformation challenges of traditional culture.

2. CURRENT STATUS OF QI CULTURE DEVELOPMENT

At present, the application of financial technology (FinTech) in Qi Culture development remains in its nascent stage, characterized by pilot initiatives and localized explorations. Local governments have undertaken some attempts to integrate FinTech with cultural initiatives. In 2023, select Qi Culture-related venues adopted the digital yuan (e-CNY) payment system, primarily for ticket and cultural creative product sales. By 2025, several banks leveraged digital finance to boost consumer spending, introducing smart dining systems, cultural tourism vouchers, and "trade-in" subsidies. These measures have served over 1,000 merchants and stimulated consumption exceeding 100 million yuan, contributing to enhanced local economic vitality.

Regarding financing for cultural enterprises, local financial institutions such as banks have introduced specialized credit products tailored to the cultural industry. However, data from the local financial regulatory authority reveals that the majority of beneficiaries are large-scale enterprises, while small and micro cultural businesses—particularly intangible cultural heritage (ICH) projects—receive limited financial support.

From an implementation perspective, several challenges persist in applying FinTech to Qi Culture. On one hand, the high cost of technological adoption—such as 3D modeling for cultural relic digitization—poses financial pressure on small and medium-sized cultural institutions. On the other hand, the integration between technology and culture requires improvement, as some projects exhibit a disconnect between technological applications and cultural essence. A 2024 sample survey conducted by Shandong Province's Department of Culture and Tourism found that approximately 40% of respondents expressed a desire for better fusion of technological displays with cultural depth in tourism initiatives.While supportive policies have been introduced at the governmental level, further refinement is needed in implementation rules and complementary measures to ensure effective execution.

3. THE THEORETICAL LOGIC OF FINTECH EMPOWERING QI CULTURE

The integration of financial technology (FinTech) with Qi Culture inheritance demonstrates both technological compatibility and cultural innovation value. The distributed storage characteristics of blockchain technology can be applied to the digital preservation of cultural heritage. For instance, after conducting 3D scanning of cultural relics from the ancient Qi capital ruins, blockchain-based notarization can ensure data authenticity and traceability.

On the consumer side, the promotion of the digital yuan (e-CNY) enables innovative cultural consumption scenarios. Museums, for example, can enhance visitor experience and operational efficiency by integrating digital yuan payments with cultural IP marketing strategies.

At the industrialization level, FinTech helps alleviate financing constraints for cultural enterprises. By utilizing big data to construct credit evaluation models, tailored financing products can be developed to address the unique characteristics of Qi Culture-related SMEs—such as their asset-light nature and the challenges in quantifying IP value.

Furthermore, consumer data analytics technology can optimize the precision of cultural product supply. For example, analyzing tourist behavior data allows for adjustments in cultural tourism project operations, achieving efficient supply-demand matching.

4. PRACTICAL PATHWAYS FOR FINTECH TO EMPOWER QI CULTURE

4.1 Digital Preservation and IP Development

Promoting innovative applications of blockchain technology in Qi Culture preservation should focus on establishing a "Qi Culture Digital Resource Repository." Key cultural elements such as bronze inscriptions, pottery patterns, and Cuju movement diagrams should undergo blockchain notarization. This technical solution ensures reliable attribution of core cultural assets while establishing a traceable foundation for subsequent industrial development. For implementation, reference can be made—though not limited—to the

technical framework of the Dunhuang Academy's "Digital Dunhuang" project, with customized data collection and storage standards adapted to Qi Culture's distinctive, robust aesthetic.

For intellectual property (IP) value conversion, it is recommended to explore the contemporary relevance of historical legacies like Guan Zhong's reform philosophies and Yan Ying's diplomatic wisdom, establishing a multidimensional cultural symbol evaluation system. When facilitating cultural asset circulation through digital copyright trading platforms, a dual-track review mechanism should be implemented: a cultural review panel comprising archaeologists and ICH inheritors, alongside a commercial evaluation group of legal experts and market analysts. This ensures each project balances cultural authenticity with market viability—a protective development strategy that maximizes socioeconomic benefits while preserving cultural essence.

4.2 Smart Cultural Tourism and Consumption Innovation

Qi Culture's digital promotion should integrate with the digital yuan (e-CNY) pilot program to create signature "e-CNY + cultural consumption" scenarios at landmarks like Zhoucun Ancient Commercial Town. For instance, designing digital red envelopes featuring Qi Culture totems (redeemable for bronze replicas or Cuju merchandise) enhances payment experiences while boosting local specialty sales.

Concurrently, innovate community participation mechanisms for ICH transmission. Support inheritors of porcelain repair (Juci) or Lu embroidery to launch tool upgrades or product R&D via crowdfunding platforms. This model not only raises funds but also engages cultural enthusiasts in co-creation. Real-time feedback communities can refine traditional crafts to align with modern aesthetics and practical needs, achieving synergistic interaction between living heritage preservation and market-oriented development.

5. KEY CHALLENGES AND COUNTERMEASURES

Balancing technological applications with cultural preservation is paramount. Prioritize mature technologies like blockchain notarization for authenticity assurance, while cautiously evaluating emerging tools (e.g., AI-generated content) to prevent cultural distortion. For data security, strictly comply with China's Personal Information Protection Law, employing privacy-computing technologies when processing tourist behavioral data.

A sustainable operational model should combine "government guidance + market operation," exemplified by establishing a Qi Culture Digital Industry Development Fund to attract private capital. Talent development is equally critical: assign dedicated digital assistants to key ICH projects and design senior-friendly interfaces to bridge the technology gap for elder inheritors.

6. CONCLUSION AND RECOMMENDATIONS

Qi Culture's digital transformation requires systematic implementation. Blockchain-based notarization platforms provide verifiable digital identities for relics and ICH, while smart payments and crowdfunding revitalize cultural consumption markets. Deep digital IP development unlocks new value-conversion channels.

A "policy guidance + market operation" dual-drive model is advised: special funds can support technological breakthroughs, while regional collaboration optimizes resource allocation. Future advancements like Decentralized Autonomous Organizations (DAOs) may enable global participation in Qi Culture innovation—though vigilance against excessive commercialization remains essential. Technological empowerment must consistently serve cultural depth rather than superficial novelty, ensuring authentic creative transformation.

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