

A Brief Discussion on Strategies for Deepening Vocational Education Reform

Lifeng Lu*

Aksu Technician College, Aksu 843000, Xinjiang, China

**Author to whom correspondence should be addressed.*

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Abstract: In the new era, the Party and the country have attached great importance to the development of vocational education. Educational authorities have successively issued a series of important documents, such as the National Vocational Education Reform Implementation Plan and the Vocational Education Quality Improvement and Excellence Cultivation Action Plan (2020–2023), which further clarify the guiding ideology, school-running orientation, objectives, tasks, and social functions of vocational education, pointing out the direction for the development of vocational colleges. With social transformation and changes of the times, vocational education has encountered many challenges. It is urgent to promote reforms in terms of fundamentals and institutions, release and develop the productive forces of vocational education, and enable vocational education to better meet the needs of the development of the socialist market economy and the promotion of social harmony and stability.

Keywords: Vocational education; Opportunities and challenges; Vocational education reform

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1. Introduction

Vocational education is an important part of national education and plays a pivotal role in the country's economic and social development. In the face of a series of problems and deficiencies in vocational education, deepening vocational education reform is an important measure to implement the Third Plenary Session of the 20th Central Committee of the Communist Party of China, as well as the only way to solve problems and promote high-quality development of vocational education. The following is a brief analysis of several issues concerning deepening vocational education reform from the perspective of the practice of vocational education development in Xinjiang (Southern Xinjiang).

2. Opportunities and challenges facing the development of vocational education in southern Xinjiang at present

As a border area of the motherland, vocational education in Xinjiang, especially in southern Xinjiang, not only

shares the common characteristics of vocational education across the country but also has its own particularly prominent uniqueness. On the one hand, like vocational education nationwide, vocational education in southern Xinjiang is ushering in a once-in-a-lifetime development opportunity. This opportunity stems from the major decisions and arrangements made by the Party Central Committee with General Secretary at its core, based on both domestic and international situations from a strategic and overall perspective, which are crucial to the country's economic and social development. Located in a key region of the Belt and Road Initiative, southern Xinjiang boasts relatively superior geographical advantages, policy advantages, resource advantages, and development advantages^[1]. These have created a broad space and paved a bright path for the development of vocational education in southern Xinjiang.

On the other hand, southern Xinjiang has harsh natural environment, complex social factors, a shortage of human resources, and a weak industrial foundation, making it a typical underdeveloped area in the country. At the same time, a series of contradictions and problems that hinder the development of vocational education are in urgent need of solution, such as the fragmented management system of vocational education with excessive administrative interference; the uneven management level of vocational colleges, with occasional chaos in management and failure to accurately grasp their main responsibilities and core businesses; inefficient talent training models and low-quality talent cultivation; and deviations in the working atmosphere of vocational colleges^[2].

3. Problems in the development of vocational education in southern Xinjiang and their analysis

3.1. Intertwined internal systems, lack of management and imbalance

According to the national division of labor in vocational education, vocational education in southern Xinjiang is divided into two categories: one under the education system (education-oriented) and the other under the human resources and social security (HRSS) system (technical worker-oriented). The education-oriented vocational schools are managed by local education administrative departments through vertical management, which conforms to the rules of vertical administration. In contrast, the technical worker-oriented vocational schools under the HRSS system are subject to dual management by both HRSS departments and education administrative departments, which easily falls into the trap of “too many cooks spoil the broth”. This results in a “lopsided” situation where both are “vocational schools” but suffer from uneven management^[3]. Compared with education-system vocational schools, HRSS-system vocational schools face a broader and more complex range of businesses and directly serve various social groups, especially vulnerable groups. This often leaves them struggling to define their core responsibilities, clarify their development direction, or measure their social value. As a result, they rank at the bottom of mainstream social recognition and evaluation systems and rarely appear in the performance records of local governments^[4].

3.2. Obvious tendency toward bureaucratization in vocational education

The tendency toward bureaucratization in education is a common phenomenon, with excessive administrative interference in schools and academic affairs being widespread. As an important part of the national education system, vocational education already suffers from inherent weaknesses in the process of educational modernization, including low social recognition and widespread prejudice. It is therefore even more susceptible to bureaucratization and excessive intervention by administrative power. In southern Xinjiang, many vocational schools prioritize and cater to administrative power, leading to absurd anomalies. This results in an unclear

positioning and a lack of focus on core tasks, creating institutions that are “neither schools, nor government agencies, nor training organizations, nor enterprises”^[5].

3.3. Self-imposed restrictions, deviation from rationality, and loss of effectiveness in teaching management

Unlike the academic education system, which has strict, logical, and efficient procedures from preschool to higher education, with clear connections between stages, links, and even individual semesters, such as vocational education, due to its unique circumstances and policy leniency, enjoys greater freedom to adapt to individual needs. This should be an advantage, as it aligns more closely with “the free development of people” and better promotes social and economic development^[6]. However, due to a combination of subjective and objective factors, some vocational schools “abuse their freedom” by imposing numerous arbitrary restrictions. They overemphasize formalities and documentation, using the pretext of “seriousness and completeness” to create self-imposed constraints that hinder progress. Templates and forms proliferate, consuming teachers’ and students’ time, energy, abilities, and potential. The quality and perfection of documentation are used as rigid indicators for evaluating teachers’ performance and determining their benefits. Excessively harsh, unrealistic, and irrational disciplinary systems, such as overstrict “teaching accident” determinations are used to intimidate teachers. For example, some teachers were directly identified as having committed a general teaching accident just because they were a few minutes late for the morning reading due to work reasons. As a result, they had 2,200 yuan deducted in total that year, were directly disqualified from evaluating and selecting excellent staff and advanced individuals that year, and this also affected their professional title promotion in the past three years^[7]. Such practices severely dampen teacher enthusiasm and vitality, which in turn damages the school’s reputation and authority and alienates the staff.

3.4. Arbitrariness in student management

“Teaching is a matter of conscience” is a phrase often repeated by student managers in vocational schools. However, in practice, student management is influenced by deeply rooted and distorted views of students. Whether in systems, mechanisms, or specific guiding principles, there are unhealthy attitudes such as “treating students as machines” or even “treating students as garbage or criminals.” This leads to problems in student management, including disregard for educational laws, ignorance of students’ physical and mental characteristics, indifference to their safety and well-being, suppression of individuality, restriction of development, and arbitrary decision-making. Student management is treated frivolously, resulting in absurd phenomena such as: “five class teachers being replaced in one class within a year,” “forcing students to wear school uniforms over down jackets in freezing winter,” “making adolescents, who care about cleanliness sit on the ground for hours or stand in the scorching sun for hours” and “throwing students’ bedding and luggage on the ground like garbage”^[8]. These practices severely damage teacher-student relations, reduce students’ recognition of teachers, schools and even themselves, harm students’ physical and mental health and growth, and seriously deviate from the original purpose and mission of education.

4. Several suggestions for deepening the reform of vocational education

General Secretary pointed out, “We should deepen the reform of the school-running system and education management, and fully stimulate the vitality of the development of education”. He also emphasized, “We should attach great importance to vocational education, so that graduates of vocational colleges can have broad

prospects in their career development”. To this end, we must firm our political stance, resolutely implement the decisions and arrangements of the Party Central Committee with General Secretary at its core on the reform and development of vocational education, shoulder our political responsibilities, adhere to seeking truth from facts, and make every effort to promote the modernization of vocational education ^[9].

4.1. Emancipate the mind and strive to solve fundamental problems in the development of vocational education

Solving ideological problems is the fundamental prerequisite for solving all problems. As an important part of the national education system, deepening the reform of vocational education in southern Xinjiang must first tackle ideological issues, discard outdated ideas, and reshape its image. Currently, the biggest obstacle to the development of vocational education in southern Xinjiang is ideological rigidity and stagnation. This rigidity is mainly manifested as a widespread prejudice against vocational education, which comes not only from the government but also from society ^[10]. In short, vocational education is placed in a low position in the value sequence of policymakers and is recognized as inferior in the minds of the public. Even in the new era, some people are still unaware of the existence of vocational schools and vocational education. However, the reality we face is that in today’s era of economic globalization, large-scale social production, and increasingly refined social division of labor, the quality of vocational education has become an important indicator of a country’s economic and social development and a key support for the sustained, healthy, and high-quality development of a country’s economy ^[11].

To this end, local governments should strictly implement national plans related to the development of vocational education, earnestly change their mindset, resolutely shoulder the political task of reforming and developing vocational education with a sense of urgency that “time waits for no one” and a strong sense of social responsibility. They should promptly adjust policy orientations, formulate supporting systems, provide public services, and carry out vigorous publicity to strive to create a favorable atmosphere where “vocational education, vocational schools, and vocational school graduates are also highly sought-after”. They should guide the public to deeply, correctly, rationally, and newly understand vocational education, vocational schools, and vocational school students, and encourage the whole society to sincerely praise vocational education and compete to commend vocational school graduates who serve society with their professional skills. This will make vocational schools a great stage in the new era for displaying talents, learning skills, creating value, and realizing self-worth, and make vocational school graduates “skilled talents” and “blue-collar elites” ^[12].

4.2. Deepen reform, adhere to a unified approach to vocational education, allow diverse development, and form synergy

The classification of the vocational education system should adhere to a unified approach. Whether it is vocational schools under the human resources and social security system or those under the education system, they should adhere to the general direction of educational attributes. Professional matters should be assigned to professional departments, and professional standards and principles should be consistently implemented to ensure that vocational schools under different systems are aligned in political direction, school-running purposes, basic operations, daily management, and result orientation, and work together toward the same goals. At the same time, the particularities of different systems should be taken into account to form a symphonic cooperation of vocational education across different systems ^[13].

General Secretary pointed out that “schools should run their own affairs”. This requires education

administrative departments and relevant administrative departments to exercise prudence and restraint, reduce interference in schools' main responsibilities and businesses, ease restrictions on vocational schools, guide and promote vocational schools to continuously deepen reforms around the central task of education and teaching, strengthen top-level design, formulate development plans, and strive to improve the quality of talent cultivation.

4.3. Prioritizing effectiveness: unleashing and developing the productive forces of vocational education

“Contradictions possess particularity”. As Comrade Deng Xiaoping put it, “It doesn’t matter whether a cat is black or white, as long as it catches mice, it’s a good cat”. The defining feature that distinguishes vocational education from academic education lies in its flexibility and practicality. Therefore, the development of vocational education can only achieve substantive progress by adhering to its “innate nature” and fulfilling its “divine mission”.

Vocational schools should focus their teaching management on the fundamental task of enhancing teaching effectiveness. This involves constructing teaching management systems that remain open, dynamic, and inclusive. By integrating principle with flexibility, vocational schools should design and implement a comprehensive set of mechanisms to encourage teaching reforms and innovations. These mechanisms should guide and support teachers and students in conducting diverse teaching practices centered on the twin objectives of moral cultivation and skill development. The ultimate and indeed the sole criterion for evaluating teaching quality should be the effectiveness of instruction and the outcomes of student nurturing, thereby eliminating all forms of formalism ^[14].

4.4. Upholding conscience: infusing student management with compassion and strength

The root cause of chaos in student management within vocational schools’ stems from administrators’ erroneous perceptions of students and their lack of empathy. Ideas are the forerunners of actions: correct ideologies propel progress, while misguided ones lead astray. For student managers, flawed perspectives on students can profoundly impact the well-being and mental health of hundreds or even thousands of young individuals. As educators, we must recognize that vocational students are, first and foremost, students and students are, at their core, children who inherently need love. The renowned educator Vasily Sukhomlinsky once stated, “Without love, there is no education”. Indeed, love constitutes the cornerstone of successful education. The essence of student management is not mere control but service, the two are inseparable, like two sides of the same coin. The principle “Care for the young as if they were your own” serves as both the ethical foundation and practical approach for student management. Confucius remarked, “A person who is filial and fraternal is unlikely to be rebellious”. Similarly, genuine care and service toward students foster trust and respect. When students are treated with the same dedication as one’s own children, they will stride confidently toward success, bringing pride to their teachers. Thus, by grounding management systems in love, we ensure they remain true to their purpose and avoid deviation ^[15].

5. Conclusion

In summary, the development of vocational education remains a daunting yet critical endeavor. It requires concerted efforts to reform institutional frameworks, management systems, power dynamics, teaching methodologies, student care, and cultural paradigms. By addressing systemic flaws and rectifying harmful practices, we can safeguard the roots of vocational education with political and scientific rationality. Through

internal and external collaboration, we must empower vocational schools to undergo self-renewal, leveraging their confidence and capabilities to deliver tangible educational outcomes that serve the nation and society.

Disclosure statement

The author declares no conflict of interest.

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Exploration and Practice of the “Cultivation–Growth–Incubation” Talent Training Model in the Master Skills Studio

Zhenjiang Shi*, Junyi Li, Fei Lu

Guangdong Open University (Guangdong Polytechnic Vocational College), Guangzhou 510091, Guangdong, China

**Author to whom correspondence should be addressed.*

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Abstract: In the context of the rapid advancement of intelligent manufacturing, ensuring the alignment of the skill levels of embedded system developers with industry requirements has emerged as a crucial aspect in the reform of vocational education. This research delves into a three-stage progressive talent cultivation model denoted as “Cultivation–Growth–Incubation”, which is founded on the Shi Zhenjiang (Z. S.) Intelligent Embedded System Development Master Skills Studio. By means of hierarchical training, project-driven strategies, and industry-academia cooperation, this model effectively elevates students’ application capabilities and innovative competencies in embedded systems. Case analyses illustrate the practical efficacy of the model, providing valuable references for the establishment of master skills studios in vocational education.

Keywords: Skill master studio; Embedded system development; Talent training mode; Operation mechanism; Industry-education integration

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1. Introduction

As a core technological underpinning for intelligent manufacturing, the Internet of Things (IoT), and industrial automation, embedded systems are experiencing a surge in the demand for talent. Nevertheless, traditional education models are plagued by a disjunction between theory and practice, as well as a skills gap between training programs and industry requirements. This has led to an inadequate supply of embedded technology professionals to satisfy corporate needs. Skill Master Workshops, which serve as crucial platforms for the integration of industry and education in vocational education, amalgamate resources from industry experts, corporate projects, and educational institutions. This innovative approach offers a novel avenue for cultivating technical talents, effectively rectifying the deficiencies in higher vocational education and enhancing teachers’ professional capabilities. By establishing school-enterprise collaboration platforms, these workshops substantially elevate the quality of talent cultivation in vocational education ^[1].

The “Z. S. Intelligent Embedded System Development” Master Skills Studio, spearheaded by provincial-level technical expert Z. S., centers on the development of embedded systems. Upholding the tenets of student skill development, it has formulated a three-stage progressive talent cultivation model of “Cultivation–Growth–Incubation”, underpinned by optimized operational mechanisms ^[2]. This paper scrutinizes the studio’s practical experience from three dimensions: model construction, mechanism innovation, and implementation outcomes. It probes into the theoretical underpinnings and core objectives of the “Cultivation–Growth–Incubation” model, elaborating on its implementation framework. The research also explores innovative operational mechanisms, analyzing how dynamic management systems guarantee scientific talent development and how collaborative resource integration boosts training efficacy ^[3]. By summarizing practical achievements, it emphasizes remarkable feats in enhancing student competencies, aligning talent cultivation with industry requirements, and expanding the studio’s brand influence. These findings offer comprehensive references for the establishment of master skills studios in vocational education.

2. The construction rationale and implementation pathway of the “cultivation–growth–incubation” talent cultivation model

In the exploration of the “Z. S. Intelligent Embedded System Development” Master Skills Studio, the three-stage progressive talent cultivation model of “Cultivation–Growth–Incubation” adheres to the phased development law of students’ technical skills. Through systematic and step by step guidance, it facilitates students to advance from the accumulation of fundamental knowledge, the improvement of practical abilities, to the stimulation of innovative thinking, thereby attaining comprehensive development.

2.1. Theoretical foundation and core objectives of model construction

2.1.1. Theoretical foundation

The “Cultivation–Growth–Incubation” talent development model is based on the constructivist learning theory and the principles of professional growth. Constructivism posits that learning entails learners actively constructing knowledge systems via practical participation. Professional growth adheres to a sequential trajectory from the acquisition of fundamental skills to comprehensive application, ultimately leading to innovative practice. Capitalizing on the high practicality, rapid iteration, and interdisciplinary characteristics of embedded technology, the studio arranges students’ skill development into three interrelated stages: cultivation, growth, and incubation, thus establishing a coherent training framework.

Moreover, the theory of multiple intelligences offers theoretical backing for this talent cultivation model. Every student has distinct combinations of intellectual advantages. In the realm of embedded system development, certain students exhibit excellence in hardware design, whereas others display proficiency in software development. The Master Skills Studio fully respects individual disparities and adopts customized teaching strategies. By means of diversified instructional techniques and project-based tasks at various developmental phases, it activates students’ dominant intelligences, allowing each learner to realize their fullest potential in appropriate domains and improve their comprehensive competencies in embedded system development.

2.1.2. Core objectives

The “Cultivation–Growth–Incubation” talent development model is designed to cultivate innovative technical professionals equipped with core competencies in embedded system development and industry relevant expertise ^[4]. This model encompasses the following aspects: reinforcing students’ fundamental knowledge in

embedded technology by mastering core skills such as hardware selection and software development; improving their practical project capabilities and teamwork skills to independently accomplish competition tasks or corporate projects; and nurturing students' innovative thinking to formulate problem solving approaches based on technical expertise.

Emphasis is placed on students' understanding of the comprehensive application of embedded systems and their ability to solve practical problems through teamwork when completing challenging competition projects after mastering individual skills.

2.2. Implementation of the three-stage progressive training path

2.2.1. Cultivation group: Consolidate the foundation and establish the technical framework

The advanced training program is tailored for junior students, emphasizing the systematic cultivation of the fundamentals of embedded technology. Employing a "Theory + Modular Training" methodology, the curriculum deconstructs embedded technology into modules, including hardware circuit design, C programming, operating system applications, and sensor interface development. Each module is accompanied by 10–15 practical tasks. For example, in the sensor interface module, students acquire basic data acquisition and signal processing techniques by undertaking projects such as the design of temperature/humidity monitoring devices based on STM32 and the development of infrared remote-control modules.

Additionally, the training group implemented the mentorship system. The core teachers of the studio collaborated with enterprise technicians to compile the "Basic Training Manual of Embedded Technology". This manual delineated the skill objectives, assessment criteria, and learning resources for each module, thereby ensuring the standardization and normalization of the training.

2.2.2. Growth group: Promote learning through competitions and enhance comprehensive application capabilities

The Growth Group focuses on upper-year students possessing foundational skills, providing advanced training via competition-driven projects. The studio selects events such as the "Embedded System Application Development" category in the Guangdong Vocational College Skills Competition and the Internet + Innovation & Entrepreneurship Contest and organizes training through a systematic process, including project decomposition, task assignment, team cooperation, and outcome evaluation. For example, in the preparation for the Guangdong Vocational College Skills Competition, students engage in the "Intelligent Warehouse Robot Control System Development" project, which integrates path planning, motor drive and wireless communication technologies. Through weekly iterations and monthly reviews, they improve their problem-solving abilities.

The growth group adheres to the principle of "Enhancing Teaching via Competitions". It mandates that students document the project development log throughout the training process, encompassing analyses of technical challenges, solutions, and team division of labor. Skill master Shi Zhenjiang conducts regular evaluations of these logs to guide students in cultivating the habit of "Reflective Learning".

2.2.3. Incubation group: Strengthening innovative practical capabilities through school-enterprise collaboration

The incubation program is designed for senior students possessing robust technical proficiency, offering practical training via "Real Enterprise Projects". In collaboration with local smart manufacturing enterprises, the studio initiates product upgrade and technological transformation endeavors, such as the development of embedded modules for industrial equipment monitoring systems and the optimization of firmware for smart

home controllers. Students engage in project teams across the entire process, spanning from requirement analysis and solution design to code writing and testing acceptance, under the guidance of both industry engineers and master mentors from the studio.

For example, in a company's "Upgrade Project of Smart Meter Data Collection Module", students from the incubation group optimized the communication protocol of embedded chips. As a result, the data transmission efficiency was increased by 30%, and they obtained technical recognition from the enterprise. These types of projects not only improve students' technical application abilities but also assist them in comprehending the core logic of technology serving industrial requirements.

3. Innovation and practice of the operational mechanism of the skill master studio

Administrative departments at all levels in China have successively promulgated guiding documents regarding the establishment of Skill Master Workshops. The aim is to offer robust policy support for their efficient operation through optimizing resource allocation, enhancing industry-university-research cooperation, and facilitating technical exchanges and innovation^[5]. Among these aspects, the innovative operational mechanisms of Skill Master Workshops have emerged as a crucial determinant in promoting the development of high-skilled talent teams.

3.1. Dynamic management mechanism: Ensuring the scientific nature of talent cultivation

3.1.1. Entry and exit mechanism

The cultivation group adopts a model of "Voluntary Application + Basic Test", with the assessment encompassing the fundamentals of electronic circuits and programming basics. The growth group is selected from the cultivation group, stipulating that candidates must complete at least 8 training modules and pass evaluations. The incubation group is chosen from the growth group, demanding the demonstration of competition awards or the ability to complete independent projects.

An exit mechanism of "Quarterly Assessment + Dynamic Adjustment" is implemented. Students who fail to pass the assessment twice consecutively or are absent from training without valid reasons will be transferred to lower-level groups or advised to withdraw, thereby ensuring the enthusiasm of the team.

3.1.2. Assessment and evaluation mechanism

Establish a two-dimensional evaluation system that integrates "Process-Oriented Assessment and Outcome-Based Evaluation". The cultivation group emphasizes three crucial metrics: the quality of module training completion (60%), the comprehensiveness of technical documentation (20%) and the performance of team collaboration (20%). The growth group assesses the outcomes of competition projects (50%), the standardization of technical documents (30%), and the performance of defense presentations (20%). The incubation group employs a dual standard approach that combines "Corporate Evaluations and Technical Indicators", where corporate evaluations account for 60% (including project progress and communication skills) and technical indicators constitute 40% (such as code efficiency and solution innovation).

3.1.3. Reward and punishment mechanism

Awards shall be bestowed upon competition winners via credit recognition and material incentives. Students in the incubation group who successfully complete enterprise projects shall receive performance-based allowances commensurate with their project contributions, and they shall be given priority in employment

recommendations. On an annual basis, “Technical Stars” and “Innovation Masters” will be selected. Students who violate studio regulations (e.g., causing equipment damage or project delays) shall be subject to a tiered disciplinary system, including warnings, temporary suspension from project participation, and ultimately expulsion, thereby strengthening the awareness of accountability.

Simultaneously, a creative fund has been established to support students in translating excellent ideas into actual projects. Outstanding teams are provided with opportunities for overseas exchange and learning to expand their perspectives. Through a series of incentive and restraint mechanisms, a positive, rigorous, and realistic learning atmosphere is fostered.

3.2. Collaborative guarantee mechanism: Integrate resources and enhance training efficiency

3.2.1. Daily technical training mechanism

The studio adopts a “5 + 2” training model, specifically, holding two-hour technical seminars every weekday evening and full day project training on weekends. A shared technical platform is established to upload resources including training materials, project codes, and troubleshooting solutions to facilitate self-directed learning. Regular technical salons are organized, during which industry experts share cutting edge technologies such as embedded AI algorithms and edge computing applications, thereby expanding students’ horizons. Through practical case studies, new technologies are expounded in an accessible manner with respect to their real-world applications and implementation methods in embedded system development, guiding students to incorporate these advanced technologies into their own projects.

Additionally, the studio conducts a technical assessment on a monthly basis, encompassing the theoretical knowledge and practical skills acquired within the current month, with the aim of comprehensively evaluating students’ learning status. Teachers consistently adjust the training plan in accordance with the assessment results to guarantee the stable enhancement of students’ knowledge and skills.

3.2.2. Management mechanism for enterprise technical service projects

In the project planning stage, a project coordination team should be established to clarify requirements with enterprises, determine timelines, and sign project responsibility agreements. The team is required to conduct a comprehensive needs analysis to guarantee a clear comprehension of the enterprise’s project objectives, functional specifications, and performance criteria. When determining timelines, the complexity of the project, the skill levels of students, and potential risks should be fully taken into account, and tasks and deliverables should be strategically arranged across different phases.

In the project implementation stage, a “Weekly Meeting + Progress Report” system is implemented. The project leader provides updates that comprehensively detail the tasks accomplished, the challenges encountered and their corresponding solutions, along with the subsequent steps. Progress reports are required to precisely mirror the actual project timelines, thus offering a foundation for monitoring and making adjustments. By means of this approach, students acquire the ability to complete tasks within the stipulated deadlines, thereby improving both project management competencies and teamwork capabilities.

In the project summary stage, corporate representatives and school administrators are invited to participate in the project outcome presentation, during which students showcase their achievements and receive feedback. Students are required to precisely expound on the project’s background, objectives, technical solutions, implementation process, and final outcomes, while highlighting their contributions and learning gains. This presentation functions as a vital means for students to reflect on their experiences and pinpoint areas for enhancement, which will facilitate their continuous development in future academic and professional pursuits.

3.2.3. Knowledge sharing and collaboration mechanism

The studio has instituted a mentorship mechanism in which senior students act as technical advisors for junior members, thereby establishing a practical learning milieu. Monthly technical seminars are arranged to promote knowledge dissemination. During these seminars, participants showcase their recent accomplishments or project experiences, such as optimizing multi task scheduling in FreeRTOS based systems and formulating low power design methodologies for embedded systems, which facilitates collaborative knowledge interchange.

The online knowledge sharing platform developed by the studio empowers students to upload study notes, project codes, technical documents, and other materials for mutual learning. Equipped with categorized directories and search capabilities, it enables effective resource exploration. Moreover, the platform incorporates specialized discussion forums where students can exchange perspectives, pose queries, and engage in collaborative deliberations with their peers.

The studio systematically arranges team project activities to promote collaboration among students. In these projects, participants engage in collaborative efforts according to their respective strengths and professional expertise to accomplish tasks. Through such teamwork, students not only enhance their technical proficiencies but also cultivate a spirit of teamwork and communication capabilities. After project completion, students exchange their perspectives and experiences, summarize the lessons learned, and apply these learnings to more effectively utilize team strength in future academic pursuits and professional endeavors.

4. Practical outcomes

4.1. The skill levels of students have been notably enhanced

In the past two years, the studio has trained 50 students, among whom 30 have joined the Growth Group and 15 have entered the Incubation Group. Students in the Growth Group have achieved 21 awards in national and provincial skills competitions, specifically including 2 third place awards at the national level, 2 first place awards and 3 second place awards at the provincial level, along with 14 third place awards at the provincial level. The Incubation Group has completed 5 corporate projects, yielding direct economic benefits exceeding 200,000 yuan for partner companies.

4.2. Talent cultivation is precisely aligned with industrial requirements

By integrating state of the art technologies and leveraging real industrial project cases, the studio has improved the practical skills and innovation capabilities in talent cultivation. It has also provided the society with a substantial number of high-quality talents equipped with international perspectives and innovation capabilities.

Based on follow up surveys, the employment rate of the studio's graduates reached 100%. Among them, 85% were employed by enterprises in the intelligent manufacturing and IoT sectors, taking on positions such as embedded development engineers and hardware testing engineers. Company feedback indicated that graduates from the studio exhibited rapid adaptability and strong problem-solving abilities, with a probation period pass rate 40% higher than that of regular graduates.

4.3. Enhance the brand influence of the studio

Since the implementation of the "Cultivation–Growth–Incubation" model, a replicable experience framework has been established. The studio has received visits from five sister institutions for academic exchanges. In the process of the development of the Master Skills Studio, faculty members have considerably improved their professional knowledge and technical abilities ^[6]. Significantly, the innovative teaching methods developed

by the technical team led by Master Skills Expert Shi Zhenjiang have gained extensive acclaim, enabling the studio to be awarded the prestigious “Innovative Teaching Faculty Team” honor by the university. This accomplishment has significantly enhanced the studio’s industry reputation and academic influence.

5. Conclusions

The “Cultivation–Growth–Incubation” talent development model has realized systematic training for embedded technical professionals via a hierarchical progression of cultivation approaches and a scientifically rational operational mechanism. Under the guidance of master technicians, implemented through project - based practice, and supported by school-enterprise cooperation, this approach effectively resolves the disjunction between academic learning and practical application. It offers a practical framework for the establishment of master technician studios in vocational education.

In the future, the studio will further strengthen the integration of industry and education, optimize the training model and operational mechanism, endeavor to cultivate higher quality technical and skilled talents that meet industrial requirements, and contribute to the development of the intelligent manufacturing industry.

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Innovation in English Translation Teaching based on Artificial Intelligence

Xuejiao Zhu*

Guangzhou Xinhua University, Guangzhou 510520, Guangdong, China

**Author to whom correspondence should be addressed.*

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Abstract: English translation teaching must also evolve against the backdrop of rapid advancement in AI. There are many problems and limitations in the traditional English translation teaching model, such as students' over-reliance on translation software, teachers' insufficient understanding of intelligent technology and insufficient integration of teaching and intelligent technology, which cannot meet the diversified learning needs of students. This paper tries to explore Innovative strategies for Artificial Intelligence (AI) based English translation teaching, including enhancing students' understanding and application of translation software, optimizing teachers' thinking on the application of AI technology, expanding ways to integrate translation courses with AI technology and increasing attention to AI in the course evaluation process. It aims at promoting AI-based English translation teaching and cultivating qualified English translators who meet the needs of the times.

Keywords: English translation; Artificial intelligence (AI); Innovation strategies

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1. Introduction

Language communication has become increasingly important in the context of accelerating globalization. With the function of connecting different cultures, English translation plays an irreplaceable role in international business, cultural exchanges, academic research and other fields. With the rapid development of science and technology, AI is changing all walks of life at an unprecedented speed, and the field of education is no exception. As an important competence for English majors, translation is pivotal through those undergraduate studies. Translation course needs to integrate AI technology since the ability to just convert a source language into a target language is not sufficient to meet the demands of today's job market. However, translation teaching is facing unprecedented challenges in the wave of AI. By exploring the AI-based English translation teaching mode, this paper aims to improve the English translation course so as to English majors' expertise and competitiveness in the market.

2. Problems in AI-based English translation teaching

2.1. Students' excessive dependence on translation software

In today's digital age, intelligent translation software has gradually become an important tool in the process of English translation learning^[1]. However, many students have excessive dependence on translation software which is not conducive to their studies. There are two reasons. Firstly, lots of students themselves do not have in-depth understanding of such AI technology. Many students only know how to input the original text and click the translation button to get the translation result, but they lack an in-depth understanding of the complex algorithm principles and operation mechanisms behind the software. This superficial cognitive style makes it impossible for them to evaluate the accuracy of the answers given by the software correctly when facing complex sentence structures or terminology in specific fields. They are prone to blindly trust the results output by the machine, which affects the development of their ability to think independently and solve problems^[2].

Secondly, there is no training or guidance for students on the application of translation software. On the one hand, due to the influence of traditional educational concepts, teachers may pay more attention to the imparting of theoretical knowledge rather than the cultivation of practical operation ability. On the other hand, due to the limited colleges' hardware facilities or individual technical proficiency, it is difficult for teachers to effectively guide students to master these modern techniques. In the English translation courses in some colleges, there is no efficient training on computer-aided translation technology and machine translation technology^[3]. As a result, although many students have access to relevant software, they can only use it simply as an auxiliary tool due to the lack of correct guidance and support, and cannot tap its potential value in depth, thus forming an excessive dependence on intelligent translation software^[4]. They do not know how to improve their translation proficiency rationally by applying AI technology.

2.2. Teachers' insufficient understanding of AI technology

The insufficient understanding of AI technology by some teachers is a key factor of restricting the improvement of AI-based English translation teaching^[5].

Firstly, some teachers of English translation courses rarely use AI translation software and translation platforms. They are accustomed to traditional teaching methods and hold a conservative attitude towards emerging AI technologies^[6]. Taking translation software only as an auxiliary tool, they occasionally mention it in class, and rarely discuss its working principles, functional characteristics and application scenarios in depth. This not only limits students' access to advanced tools, but also makes it difficult for teachers themselves to keep up with the pace of technological development.

Secondly, although there are rich books and online course resources about AI in the market, it is still a great challenge for lots of teachers to learn AI technology and apply it in translation teaching. This leads to a vicious circle: teachers dare not easily apply AI technology in translation course due to insufficient AI knowledge, and it would be more difficult for them to learn more AI knowledge due to insufficient AI technology application in translation course.

Thirdly, the support from colleges or universities is insufficient. AI training programs for teachers are insufficient, which makes it difficult for teachers to explore the application of intelligent technology in English translation teaching^[7].

2.3. Insufficient integration of teaching and intelligent technology

In the extracurricular time, some students only use intelligent translation software as a convenient tool to look up words or phrase, without exploring its potential in depth^[8]. When faced with a complex English document,

students tend to input it word by word into online translation platforms for literal translation, resulting in translations that are usually grammatically incoherent and logically confusing. With this approach, students not only fail to understand the connotation of the source text accurately, but also cannot improve their own translation ability.

2.4. Limited intelligent application in course evaluation

Firstly, there is insufficient evaluation on teachers' application of AI technology in translation course. In the current educational environment, some colleges and universities have limited application of AI technology. In English translation teaching based on AI, the ways that teachers use AI technology in the translation teaching process are not evaluated comprehensively and accurately. Evaluators can only observe superficially whether teachers use these tools, but it is difficult to conduct in-depth assessments of whether their usage is scientific and reasonable, and whether they truly improve teaching quality^[9].

Secondly, there is no sufficient and rational evaluation on students' application of AI technology in translation course. There is insufficient coverage of AI technology in the curriculum evaluation standards of English translation majors in some colleges and universities. The existing evaluation standards focus more on the mastery of basic knowledge and the proficiency of basic skills, while the requirements for knowledge and skills related to AI technology are relatively low^[10]. In the course assessment stage, there are almost no special questions or weights set for students' understanding and operation of intelligent translation systems, as well as their ability to analyze and improve machine translation results. This evaluation orientation is not conducive to stimulating students' enthusiasm for actively exploring emerging technologies, nor is it conducive to schools timely adjusting and improving talent training programs to meet the needs of industry development, which further exacerbates the disconnection between course evaluation and actual teaching objectives.

3. Innovative strategies for AI based English translation teaching

3.1. Enhancing students' understanding and application of translation software

Firstly, College English teachers need to guide students to have a correct understanding of using AI translation technology, making students realize that AI translation tools are only auxiliary tools, not a complete replacement for human translators^[11]. Students should be aware that traits such as human thinking, cultural understanding, and language sensitivity cannot be replicated by machines. Teachers can set up special training on how to apply translation software correctly. For translation exercises of specific text types, teachers can guide students to make adequate preparations before translation, such as vocabulary accumulation, grammar sorting, and background knowledge acquisition. When dealing with a scientific and technological literature, students need to master relevant terms first and then use translation software for assistance to ensure the quality of translation.

Secondly, teachers teaching English translation need to actively publicize and popularize knowledge about different AI translation software and platforms. For example, Google Translate has the advantage of a huge corpus, which can handle translation among multiple languages and is constantly updated to adapt to language changes. However, it has some shortcomings. For instance, it is difficult to accurately grasp the implicit cultural elements and emotions in literary works, which can lead to misunderstandings. DeepL Translator performs well in terms of sentence structure and semantic coherence, especially in translation between European languages, but there would be some problems in the translation of non-European languages. In this regard, teachers can organize lectures or classroom discussion to enable students to have an in-depth understanding of the characteristics of each platform, so that they can choose appropriate tools according to specific translation tasks^[12].

Thirdly, teachers should integrate translation courses with AI technology in the teaching process closely to improve students' translation proficiency. On the one hand, students can do translation appreciation by comparing the machine translation and the translation of themselves under the teacher's guidance, helping them to improve their translation skills and cultivate their critical thinking. For example, while translating a news report, students need to translate it all by themselves, then use translation software to compare the two versions and discuss the differences. On the other hand, encourage students to participate in project-based learning, such as simulating a translation project for a multinational company. From receiving orders to delivering the final translation, students need to use translation software for assistance throughout the process, and incorporate manual proofreading to ensure the accuracy of the final manuscript.

3.2. Optimizing teachers' thinking on the application of AI technology

In the present education mode, teachers are the core of teaching activities, and their understanding and mastery of new technologies directly affect the quality of teaching. For English translation courses, teachers need to actively adapt to and make full use of the new opportunities brought by AI technology to improve their teaching ability and better serve students' development^[13].

Therefore, schools should constantly optimize the training mechanism for teachers of translation courses. On the one hand, colleges and universities should organize various training activities regularly such as lectures and seminars on AI-based teaching, and invite scholars and experts to share cutting edge research and technical trends to help teachers obtain the latest information in a timely manner and master advanced teaching concepts and methods. On the other hand, colleges and universities should organize various training activities regularly such as lectures and seminars on AI-based teaching, and invite scholars and experts to share cutting edge research and technical trends to help teachers obtain the latest information in a timely manner and master advanced teaching concepts and methods. On the other hand, teachers need to participate in online and offline hands-on training courses on AI-assisted instruction to learn the functions and application scenarios of various AI tools. In this way, teachers can integrate AI technologies into translation teaching rationally.

3.3. Expanding ways to integrate translation courses with AI technology

In the pre-class activity, AI tools can be quite effective in teachers' teaching design and students' translation practice. On one hand, teachers can use AI tools to collect instructional resources and convert key content into short videos, creating micro-lectures that students can preview on their own. This not only helps to reduce teachers' preparation workload and boosts their efficiency, but also sparks students' interest in learning through digital ways.

In class, both teachers and students need to actively integrate AI into teaching or learning. On the one hand, teachers need to continually update teaching content, integrating the latest technologies and real-life corpora. For example, when analyzing a specific translation strategy, teachers can pair it with AI-translation demonstrations on the spot so that students can have a better understanding of the strategy. On the other hand, students need to learn CAT tools like Trados and MemoQ. For example, students can learn to use MemoQ to translate, review to ensure both translation quality and productivity. They can also do pre-translation to boost efficiency based on Translation Memory and Terminology Database. When students are proficient in CAT tools, they can process repetitive texts a lot faster. Besides, this allows the students to have the experience of evolving from mere language converters into language engineers. Apart from CAT tools, the mainstream machine translation tools, such as DeepSeek, ChatGPT, DeepL and Google Translate should also be integral in translation courses. Under

the guidance of teachers, students can compare their own translation with the translation from DeepL to analyze the translation's fluency, logic, choice of words, etc. When transiting complicated lengthy sentences that are beyond students understanding, ChatGPT can help students to understand the complicated sentence structures and cultural background and help them to translate the sentences better.

After class, teachers can use AI tools to assign diversified homework that boosts students' motivation. By allowing students to submit their work through a specific online platform, such as Xuexitong, AI can sometimes help to correct and evaluate their translation, which helps to deliver feedback to a certain extent. On the other hand, students can use AI translation tools to analyze texts and explore different translation strategies. When confronted with complex sentences or passages, they can compare multiple machine outputs and learn how to select the most appropriate translation, thereby enhancing their translation skills and cultivating the ability of thinking and solving problems independently^[14].

3.4. More application of AI in the course evaluation

Traditional evaluation methods are unable to meet the needs of teaching in modern times. Traditional evaluation is result oriented, namely only paying attention to the quality of the translation while ignoring students' ability of solving problems with the help of AI tools in the translation process. It is particularly crucial to increase the proportion of AI technology application appropriately since AI technology can provide more accurate data analysis, which helps to record subtle changes in students' learning process. In this regard, the new evaluation criteria should cover more dimensions, such as whether students can reasonably select and efficiently use Translation Memory and Terminology Database, whether they are capable of judging the accuracy of machine translation results, whether they can adjust translation strategies flexibly based on the context, etc. Specifically, the score for each dimension should be clearly listed in the grading rule for each assignment, prompting students to pay attention to and cultivate these skills actively. In the meantime, teachers also need to improve their knowledge of relevant technologies and tools constantly to fairly evaluate students' performance.

4. Conclusion

To sum up, the application of AI technology in English translation teaching has broken the limitations of traditional teaching mode. In the past, translation teaching mainly relied on teachers' analysis and students' translation practice without little integration of AI technology, which needs to be improved in terms of efficiency and personalization even though it is quite effective for some students. Therefore, this paper proposes some effective ways for improving the translation course with the help of AI technology, including enhancing students' understanding and application of translation software, optimizing teachers' thinking on the application of AI technology, expanding ways to integrate translation courses with AI technology and more application of AI technology in the course evaluation process.

With the constant development of AI technology, there would be more extensive application scenarios in English translation teaching. New AI technologies, such as intelligent speech recognition, natural language processing, machine translation and deep learning, will bring both opportunities and challenges to translation teaching. Teachers need to keep up with the cutting-edge technology, update teaching methods in time and cultivate students' interest and sensitivity to emerging technologies so as to cultivate more translation professionals for society.

Disclosure statement

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Exploration and Practice of the AVIVA Teaching Model in Foreign Language Courses of Application-Oriented Universities from the Perspective of Ideological and Political Education in Courses

Huidong Zhu*

Chongqing College of Mobile Communication, Chongqing 401520, China

**Author to whom correspondence should be addressed.*

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Abstract: Ideological and political education in courses is an important task of higher education in the new era. As a crucial part of higher education, foreign language teaching needs to actively explore effective integration with ideological and political education in courses. The AVIVA teaching model, a student-centered teaching model, provides new ideas for foreign language teaching. Based on an analysis of the current situation of foreign language courses in application-oriented universities, this article discusses the application strategies of the AVIVA teaching model from the perspective of ideological and political education in courses. Through specific teaching practice cases, it demonstrates the effectiveness of this model in improving students' foreign language proficiency and ideological and political literacy, providing a reference for the reform of foreign language teaching in application-oriented universities.

Keywords: Ideological and political education in courses; AVIVA teaching model; Application oriented universities; Foreign language courses; Teaching practice

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1. Introduction

With the acceleration of globalization, the importance of foreign language proficiency in talent cultivation has become increasingly prominent. As an important base for cultivating high-quality application-oriented talents, application-oriented universities should not only focus on the imparting of language knowledge and the cultivation of language skills in their foreign language teaching, but also pay attention to the improvement of students' comprehensive quality, especially the cultivation of ideological and political literacy. Ideological and political education in courses, as an important task of higher education in the new era, provides a new direction

and requirements for foreign language teaching. The AVIVA teaching model, proposed by the Swiss educator Stähli, emphasizes student-centeredness and focuses on the interactivity and practicality of the teaching process, which is highly consistent with the concept of ideological and political education in courses. Therefore, this article aims to explore the application strategies of the AVIVA teaching model in foreign language courses of application-oriented universities, and verify its effectiveness in improving students' foreign language proficiency and ideological and political literacy through teaching practice cases.

2. Theoretical foundations of curriculum ideology and politics and the AVIVA teaching model

Curriculum Ideology and Politics refers to the organic integration of ideological and political education into various courses during the teaching process in colleges and universities, so as to realize the organic unity of knowledge impartment, ability cultivation and value guidance. The core of Curriculum Ideology and Politics lies in moral education and talent cultivation. By exploring the ideological and political elements in various courses, it guides students to establish correct world outlooks, outlooks on life and values, and cultivates high-quality talents with a sense of social responsibility, innovative spirit and practical ability. In foreign language teaching in application-oriented colleges and universities, the implementation of Curriculum Ideology and Politics not only helps to improve students' foreign language proficiency, but also enhances their cultural confidence and national identity, and cultivates application-oriented talents with an international perspective and a sense of patriotism.

The AVIVA teaching model was proposed by the Swiss educator Stäheli. Its core concept is student-centered, focusing on the interactivity and practicality of the teaching process. This model is divided into five steps namely, A (Ankommen und Einstimmen, Content Introduction and Emotional Guidance), V (Vorwissenaktivieren, Prior Knowledge Activation), I (Informieren, Knowledge Learning), V (Verarbeiten, Knowledge Application) and A (Auswerten, Effect Evaluation) ^[1].

The AVIVA teaching model emphasizes fully mobilizing students' enthusiasm and initiative in the teaching process, and promotes students' understanding and application of knowledge through diversified teaching methods and activities, so as to cultivate students' comprehensive abilities.

Curriculum ideology and politics and the AVIVA teaching model are highly consistent in terms of concepts. Curriculum ideology and politics emphasizes the realization of value guidance in the teaching process, while the AVIVA teaching model focuses on students' dominant position and emotional experience in the teaching process, which provides a good foundation for the implementation of Curriculum ideology and politics. Through the five steps of the AVIVA teaching model, teachers can organically integrate ideological and political elements into all links of foreign language teaching, and realize the organic unity of knowledge impartment and value guidance ^[2]. For example, in the link of content introduction and emotional guidance, teachers can stimulate students' learning interest and emotional resonance by introducing ideological and political themes related to the course; in the link of knowledge learning, teachers can guide students to think about cultural differences and values in combination with foreign language knowledge, so as to cultivate students' cultural confidence and national identity; in the link of knowledge application, teachers can enable students to apply the knowledge they have learned in real scenarios and solve practical problems through practical activities, so as to enhance students' practical ability and sense of social responsibility.

3. The application strategies of the AVIVA teaching model in foreign language courses at application-oriented universities

In the content introduction and emotional guidance stage, ideological and political themes related to the course were introduced through various methods to stimulate students' learning interest and emotional resonance. By integrating current affairs hotspots, cultural festivals, and other elements, ideological and political elements relevant to the course are incorporated to guide students to reflect on cultural differences and values.

Meanwhile, multimedia teaching tools are used to display course-related pictures, videos, and other materials, creating a favorable learning atmosphere and helping students quickly enter a learning state. For instance, when teaching the theme of "Chinese Culture", teachers can present pictures and videos of traditional Chinese culture, such as celebrations of traditional festivals like the Spring Festival and the Mid-Autumn Festival. This guides students to think about the value and significance of traditional Chinese culture, and stimulates their learning interest and emotional resonance.

In the background knowledge activation stage, students are guided to review course-related background knowledge through questioning, discussion, and other methods, thereby activating their existing knowledge and experience. At the same time, combined with ideological and political elements, students are led to reflect on cultural differences and values, helping them establish a correct worldview and outlook on life. For example, when teaching the theme of "Environmental Protection", teachers can ask students about their understanding of environmental protection, guiding them to review background knowledge related to environmental protection, such as the current state of environmental pollution and the importance of environmental protection^[3]. Additionally, by integrating ideological and political elements, students were encouraged to think about the relationship between environmental protection and sustainable development, fostering their sense of social responsibility and environmental awareness.

In the knowledge learning stage, students are guided to learn foreign language knowledge and ideological and political knowledge related to the course through teaching methods such as explanation, discussion, and case analysis. Teachers, while teaching foreign language knowledge, guide students to reflect on cultural differences and values, cultivating their cultural confidence and national identity. When teaching the theme of "Cross-Cultural Communication", case analysis is used to lead students to think about communication methods and values under different cultural backgrounds, developing their cross-cultural communication skills and cultural confidence. Simultaneously, combined with ideological and political elements, students are guided to consider how to promote excellent traditional Chinese culture in cross-cultural communication, enhancing their national identity and cultural confidence.

In the knowledge application stage, teachers can organize practical activities to enable students to apply the knowledge they have learned in real scenarios, solve practical problems, and strengthen their practical abilities and sense of social responsibility. For example, teachers can arrange group discussions, role-plays, project-based learning, and other activities, allowing students to apply their acquired knowledge to solve practical problems in practice. At the same time, teachers can integrate ideological and political elements to guide students to reflect on how to practice core socialist values in practice, cultivating their sense of social responsibility and innovative spirit^[4]. For instance, when teaching the unit of "Business Foreign Language", teachers can organize students to carry out simulated business negotiation activities. This allows students to apply the business foreign language knowledge they have learned to solve practical problems in practice. Meanwhile, combined with ideological and political elements, teachers guide students to think about how to practice core socialist values such as integrity and cooperation in business negotiations, fostering their sense of social responsibility and innovative

spirit.

In the effect evaluation stage, teachers can adopt a variety of evaluation methods, such as classroom performance evaluation, homework evaluation, and exam evaluation to conduct a comprehensive assessment of students' foreign language proficiency and ideological and political literacy. Teachers can design diversified evaluation indicators by integrating ideological and political elements, including students' classroom participation, group cooperation ability, cross-cultural communication ability, and sense of social responsibility, to comprehensively evaluate students' learning effects. Additionally, teachers can obtain students' feedback to understand their acceptance and recognition of ideological and political education in the course, and adjust teaching methods and content in a timely manner to improve teaching quality^[5]. For example, at the end of the course, teachers can design a questionnaire survey to understand students' acceptance and recognition of ideological and political education in the course, as well as their suggestions and opinions on course teaching. Based on students' feedback, teachers can adjust teaching methods and content promptly to enhance teaching quality.

4. Practical case analysis of the AVIVA teaching model in foreign language courses at application-oriented universities

This practical case takes the "College Foreign Language" course at a certain application-oriented university as the research object. The teaching objectives of this course are to cultivate students' foreign language application ability and intercultural communication competence, while attaching importance to the cultivation of students' ideological and political literacy. The teaching targets are first year students, who have a relatively good foreign language foundation but lack sufficient understanding of ideological and political education in courses. The teaching content includes modules such as foreign language knowledge, intercultural communication, and Chinese culture, with diverse teaching methods and an emphasis on practical teaching links.

After one semester of teaching practice, students' foreign language application ability and intercultural communication competence have been significantly improved. Their classroom participation and teamwork skills have also been notably enhanced, and their intercultural communication competence and practical abilities have been effectively cultivated. For example, in simulated cultural exchange activities, students can skillfully apply the learned foreign language knowledge and cultural knowledge to demonstrate the charm of traditional Chinese culture, showing strong intercultural communication competence and practical abilities^[6].

Students' ideological and political literacy has been significantly improved. Their sense of identity and pride in Chinese culture have been obviously strengthened, and their understanding and recognition of core socialist values have also been significantly enhanced. In the questionnaire survey, 90% of the students said they had a high degree of acceptance and recognition of ideological and political education in the course, believing that it helps to improve their ideological and political literacy and cultural confidence. At the same time, students also put forward many constructive suggestions on course teaching, such as increasing practical teaching links and enriching teaching content, which provide references for teachers to further improve teaching methods and teaching content^[7].

Teachers have gained a deeper understanding and experience of the application of the AVIVA teaching model in foreign language courses at application-oriented universities. Teachers believe that the AVIVA teaching model emphasizes student-centeredness, focuses on the interactivity and practicality of the teaching process, and can effectively stimulate students' interest and initiative in learning, as well as improve their

foreign language ability and ideological and political literacy. Meanwhile, teachers also realize that there are still some problems and shortcomings in the teaching process, such as unreasonable allocation of teaching time and insufficient teaching resources. Therefore, in future teaching, teachers will further optimize teaching design, allocate teaching time reasonably, enrich teaching resources, and improve teaching quality.

This practical case provides useful references for the reform of foreign language courses in application-oriented universities. Through the application of the AVIVA teaching model, it not only improves students' foreign language ability and intercultural communication competence, but also enhances their ideological and political literacy and cultural confidence, realizing the organic unity of knowledge impartment and value guidance^[8]. At the same time, this practical case also provides reference experiences and methods for the reform of foreign language courses in other application-oriented universities, such as how to integrate ideological and political elements into the teaching process, how to design diversified teaching activities, and how to conduct effective teaching evaluation. Therefore, this practical case has certain promotion value and application prospects.

5. Practical issues and challenges of the AVIVA teaching model in foreign language courses at application-oriented universities

In the process of implementing the AVIVA teaching model, teachers' professional quality and competence are faced with higher challenges. Teachers are required not only to possess solid foreign language expertise and teaching capabilities but also to have a strong awareness of integrating ideological and political elements into courses also as referred as "curriculum-based ideological and political education" and the ability to implement it. However, some teachers have an insufficient understanding of the ideological and political function of foreign language courses and lack the teaching experience and methods related to curriculum-based ideological and political education. To a certain extent, this has affected the implementation effect of the AVIVA teaching model. Therefore, teachers need to continuously improve their own quality and abilities, strengthen their learning and training in curriculum-based ideological and political education, and enhance their teaching proficiency in this aspect^[9].

The implementation of the AVIVA teaching model requires the support of abundant teaching resources and good teaching conditions. Nevertheless, some application-oriented universities have certain deficiencies in terms of teaching resources and conditions, such as inadequate teaching facilities and insufficiently rich teaching resources. This has restricted the implementation effect of the AVIVA teaching model to a certain degree. Therefore, universities need to increase investment in teaching resources and conditions, improve teaching facilities, enrich teaching resources, and provide sound support for the implementation of the AVIVA teaching model.

The implementation of the AVIVA teaching model also calls for the establishment of a scientific and reasonable teaching evaluation and assessment system^[10]. However, the current teaching evaluation and assessment system still has some problems, such as unscientific and unreasonable evaluation indicators and insufficiently diversified evaluation methods. This has affected the implementation effect of the AVIVA teaching model to some extent. Therefore, universities need to further improve the teaching evaluation and assessment system, establish scientific and reasonable evaluation indicators and methods, and conduct a comprehensive evaluation of students' learning outcomes.

Students are required to participate actively and engage in independent learning. However, some students

have inadequate learning attitudes and habits, such as low learning enthusiasm and insufficient autonomous learning ability. To a certain extent, this has impacted the implementation effect of the AVIVA teaching model. Therefore, teachers need to focus on cultivating students' autonomous learning ability and good learning habits, stimulate students' interest and enthusiasm for learning, and improve their learning effects.

6. Conclusion

The application of the AVIVA teaching model in foreign language courses at application-oriented universities can effectively enhance students' foreign language proficiency and ideological and political literacy, realizing the organic integration of knowledge imparting and value guidance. The AVIVA teaching model emphasizes student-centeredness, focuses on the interactivity and practicality of the teaching process, and can effectively stimulate students' learning interest and initiative, thereby improving their comprehensive abilities.

At the same time, during the implementation of the AVIVA teaching model, factors such as teachers' quality and capabilities, teaching resources and conditions, teaching evaluation and assessment, as well as students' learning attitudes and habits have exerted a certain impact on the teaching effect. Therefore, teachers need to continuously improve their own quality and abilities; universities need to increase investment in teaching resources and conditions, further optimize the teaching evaluation and assessment system, and focus on cultivating students' autonomous learning ability and good learning habits to improve teaching quality. It is necessary to combine the AVIVA teaching model with curriculum-based ideological and political education, explore the application strategies of the AVIVA teaching model in foreign language courses at application-oriented universities, and verify its effectiveness in enhancing students' foreign language proficiency and ideological and political literacy through specific teaching practice cases.

However, this study has limitations such as a small research sample and a short research duration, which have affected the comprehensiveness and reliability of the research results to a certain extent. In future research, efforts should be made in the following aspects, including expanding the research sample by selecting different types of universities and students to improve the reliability and universality of the research results; extending the research duration to conduct long-term follow-up studies on the implementation effect of the AVIVA teaching model, so as to further verify its effectiveness in enhancing students' foreign language proficiency and ideological and political literacy; conducting in-depth research on the application of the AVIVA teaching model in other discipline courses, and exploring its application strategies and effects in different subject courses; further improving the teaching evaluation and assessment system, establishing scientific and reasonable evaluation indicators and methods, and conducting a comprehensive evaluation of students' learning outcomes.

Through these research efforts, more references can be provided for the curriculum reform of application-oriented universities, and the improvement of the quality of education and teaching in application-oriented universities can be promoted.

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Thoughts on the Implementation Path of General Technology Curriculum in Senior High Schools from the Perspective of New Productive Forces

Xiaoyan Su*

Changji Prefecture No.4 Middle School, Changji 831800, Xinjiang, China

**Author to whom correspondence should be addressed.*

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Abstract: From the perspective of new productive forces, the general technology curriculum in senior high schools should not only cultivate students' technical knowledge and practical abilities but also focus on the development of innovative thinking to meet the demand for interdisciplinary talents in the future society. Based on the chapter "Common Conception Methods" in the Jiangsu Education Edition of Technology and Design 1, this paper explores the implementation path of the general technology curriculum, focusing on the optimization strategies in four aspects: Project-based learning (PBL), strengthening technical practice, STEAM interdisciplinary integration, and a diversified evaluation system. It also analyzes the application of divergent thinking (brainstorming) and reverse thinking in the curriculum through cases. The research shows that optimizing teaching methods and enhancing practical links can effectively stimulate students' creativity and teamwork ability, improve the effectiveness of curriculum implementation, and provide strong support for the cultivation of future technical innovation talents.

Keywords: New productive forces; General technology curriculum; Project-based learning (PBL)

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1. Introduction

Against the background of the rapid development of global scientific and technological innovation, education must adapt to the needs of the times and cultivate high-quality talents with innovative thinking, technical literacy, and practical ability. The general technology curriculum in senior high schools is an important part of China's basic education system, aiming to enable students to master the basic principles of technical knowledge and form scientific ways of thinking and problem-solving abilities. However, there are still many problems in the traditional curriculum implementation mode, such as a single teaching method, insufficient practical opportunities, low degree of subject integration, and backward evaluation system, which make it difficult to meet the demand of new productive forces for talent cultivation^[1].

2. Connotation and significance of general technology courses in senior high schools from the perspective of new productivity

Driven by factors such as information technology, artificial intelligence, and sustainable innovation, society is developing at a high speed, and technology is playing an increasingly prominent role in production and daily life. The general technology courses in senior high schools aim to guide students to initially understand, perceive, and apply technology, thereby cultivating their innovative thinking and practical abilities. In the stage of transformation and development of new productivity, society's demand for talents' abilities is complex, diverse, and comprehensive ^[2]. Relying on real scenarios and project-based practices, general technology courses provide students with opportunities to practice hands-on control and innovative design.

Essentially, new productivity requires education to integrate multidisciplinary knowledge and cultivate the ability of cross-field thinking ^[3]. General technology courses emphasize both practice and innovation, advocating that students incorporate knowledge from subjects such as mathematics, physics, fine arts, and information technology into the design and production process. In this way, students' subject cognition will transition from narrowness to expansion, which can better stimulate their learning enthusiasm and creative potential, laying the foundation for in-depth learning of subsequent subjects. Traditional education focuses more on the imparting and memorization of knowledge, but new productivity focuses on creative thinking, problem awareness, and practical problem-solving. With the help of general technology courses, students can, under the guidance of teachers, analyze practical problems and design solutions through observation, research, discussion, and personal experience. This can not only cultivate students' innovative abilities but also enable them to understand the social responsibility and practical significance of technology in on-site experience ^[4].

3. Analysis of the implementation paths for general technology courses in regular senior high schools

3.1. Developing a project-based learning (PBL) teaching model

Project-based learning (PBL) is a teaching approach centered on practical projects. It emphasizes students' acquisition of knowledge, mastery of skills, and enhancement of problem-solving abilities in specific contexts. Compared with traditional knowledge-transmission models, PBL is more effective in stimulating students' desire for knowledge, enhancing their enthusiasm for active learning, and boosting their teamwork vitality ^[5]. In advanced general technology courses, PBL guides students in independent learning through comprehensive project tasks (such as "Design of Intelligent Environmental Protection Trash Bins," "Construction of Solar-Powered Models," and "Analysis of Sustainable Energy Systems") ^[6]. The teaching process of the PBL model typically includes multiple stages: introduction of problem scenarios, task decomposition, data collection, scheme design, production of works, result presentation, and evaluation. During the completion of projects, students not only apply technical knowledge but also engage in problem analysis, group communication, and scheme optimization, thereby fostering their innovative thinking abilities.

3.2. Promoting technical practice links to enhance hands-on skills

One of the core goals of general technology courses is to cultivate students' practical hands-on abilities, enabling them to use the knowledge they have learned to solve existing problems ^[7]. However, in daily teaching operations, due to constraints such as curriculum design, school resources, or teacher strength, the implementation effect of practical teaching links in some schools is unsatisfactory, resulting in students lacking sufficient hands-on experience ^[8]. To address such issues, it is necessary to strengthen technical hands-on links

and adopt various approaches to improve students' practical experience^[9]. Virtual simulation technology can be used to make up for the shortage of equipment resources. For example, relying on virtual simulation software like TinkerCAD and Proteus, learners can carry out online activities related to circuit design and 3D modeling, master the technical principles in the field of tools in advance, and lay the groundwork for subsequent practical operations.

3.3. Adopting the STEAM education concept to promote interdisciplinary complementarity

STEAM education is a teaching model focused on interdisciplinary integration, aiming to cultivate students' comprehensive innovation capabilities. General technology courses in regular senior high schools cover various fields such as engineering design, manufacturing technology, and material application. Therefore, adopting the STEAM education concept can effectively enhance the multi-dimensional teaching value of these courses, helping students form interdisciplinary connections and develop a gradient-based understanding of technology. Based on the STEAM education framework, the teaching of general technology courses can be realized through approaches such as "technology + science," "technology + art," and "technology + mathematics" to achieve effective integration between disciplines^[10]. For instance, during the implementation of the "Bridge Design" unit, teachers can combine the principle of force analysis from physics, require students to estimate the load-bearing capacity of the bridge, and use mathematical modeling software (such as GeoGebra or Matlab) for simulation calculations. At the same time, aesthetic design elements are integrated, allowing students to find a balance between functionality and aesthetics.

STEAM education encourages students to adopt inquiry-based learning methods. For example, in the implementation of the "Intelligent Robot Design" course, students need to apply interdisciplinary knowledge such as physics, computer programming, and electronic circuits to independently construct robot structures and then carry out programming control. To facilitate the effective implementation of STEAM education, schools can plan to build STEAM laboratories or maker spaces, equipped with 3D printers, laser cutters, electronic components, and other tools, encouraging students to carry out technological innovation in open spaces. Meanwhile, teachers can collaborate with colleagues from subjects such as mathematics, physics, and art to develop comprehensive projects through interdisciplinary cooperation, forming a teaching system where multiple disciplines mutually benefit^[11].

3.4. Developing a diversified evaluation system to stimulate students' innovative potential

In the traditional teaching evaluation system, the assessment of general technology courses mostly adopts written tests or theoretical knowledge assessments, which are unable to comprehensively evaluate students' innovative thinking, practical abilities, and teamwork skills^[12]. Therefore, against the background of emerging new productive forces, general technology courses in regular senior high schools need to establish a scientific and reasonable diversified evaluation system to promote students' creative thinking and technical practical abilities^[13]. The diversified evaluation system should include multiple dimensions such as process evaluation, work display evaluation, teamwork evaluation, and self-reflection evaluation. For example, in the "Solar Lighting Design" course, students can formulate plans at the beginning of the project, with teachers providing phased guidance; during the project implementation, teachers can record the process of students' operations and team interactions; finally, students' works should not only be evaluated through physical assessment but also through overall consideration in forms such as result displays and peer reviews^[14].

4. Case analysis: taking “common conception methods” in Jiangsu education press’s technology and design 1 as an example

As a textbook playing an important role in the general technology curriculum of ordinary senior high schools, Jiangsu Education Press’s Technology and Design 1 features the combination of universality and design, providing a strong foundation for students’ innovative design. Among them, the training of students’ design conception is extremely crucial. The textbook describes various thinking training methods in the chapter “Common Conception Methods”.

4.1. Analysis from the perspective of innovative thinking - divergent thinking method

Divergent thinking method emphasizes putting forward as many ideas as possible in a short period of time without examining their feasibility and rationality. This method can expand the boundaries of thinking, help students break through traditional constraints, and inspire creative inspiration in a “non-judgmental state”. Brainstorming activities usually set a core topic or problem^[12], allowing students to communicate and express independently, while teachers play the role of organizing, guiding and encouraging throughout the brainstorming process^[15]. The following teaching application strategies can be adopted:

First, real cases should be used in the design of teaching scenarios. For example, when starting an environmental protection packaging design, teachers can share real environmental protection issues or cases with students, and guide them to conduct preliminary research first, so as to provide sufficient material support for subsequent brainstorming.

Second, try to create a free and relaxed discussion atmosphere during brainstorming, and adopt diversified encouragement. For instance, those who “put forward the most novel ideas” can receive praise, which can greatly boost students’ enthusiasm.

Third, after the ideas are fully developed, teachers should make reasonable induction and screening, guide students to summarize and integrate their insightful ideas, and form modular design ideas. This not only maintains creativity but also avoids chaotic and illogical imagination.

Teachers assign students to improve the design of “school garbage classification”. In the idea collection stage, students can come up with various schemes: automatic classification trash cans, design of classification publicity activities, multi-functional garbage sorting robots, and even trash can appearances with artistic styles. Then teachers summarize and classify these schemes, guide students to further explore the feasibility and innovation of these schemes, and finally select one or two design ideas from many to conduct in-depth research and practice.

4.2. Analysis from the dimension of solving difficult problems - reverse thinking method

Reverse thinking method emphasizes reversing the existing cognitive system, thinking about problems from opposite or uncommon perspectives, thereby driving new design ideas and solutions. This method has important value in innovation activities of design teaching: when students encounter technical difficulties or bottlenecks in the design stage, relying on “reverse thinking” can often help them discover possibilities overlooked by conventional approaches. During teaching, it is necessary to clarify the key points and scope of “reverse thinking”. Teachers should demonstrate to students how to raise questions from opposite sides, promote the combination of divergent and convergent thinking. Reverse thinking can be understood as a highly targeted divergent activity. After students put forward ideas opposite to conventional designs, they need to use convergent thinking to screen and integrate them, and finally form practical and operable plans. It is necessary to guide students to review and record the stages. Reverse thinking is often interfered by inertial thinking in the

initial stage. Teachers should require students to constantly examine their own thinking patterns in the design process, and break through thinking set through peer evaluation, collective evaluation and other methods.

When designing an innovative portable storage device, students usually first consider how to make the device lighter and easier to carry. Teachers may give students a hint of reverse thinking: through this reverse way, students may propose to install wheels or slide rails on the device for movement. After screening and optimizing these ideas, a new design plan that takes both portability and versatility into account can be hatched.

4.3. Comprehensive application of conception methods and teaching design

In actual teaching activities, divergent thinking method and reverse thinking method are generally not used alone, but need to be properly combined to form a systematic design idea from scattered mode to focused mode, and from traditional representation to non-traditional representation. Teachers can combine the two methods in the following links.

- (a) Project introduction: Arouse students' desire for exploration by presenting focus issues or topics in reality.
- (b) Brainstorming: Put forward a large number of unique ideas for the subject without any evaluation.
- (c) Reverse thinking: Start from the perspective of abandoning the conventional to find potential breakthroughs.
- (d) Scheme screening: Evaluate the value of each idea and then integrate them, focusing on the design direction with implementability and sufficient innovation drive.
- (e) Finished product production and evaluation: Students personally implement the design scheme, and improve the design by means of peer mutual learning, user experience feedback and other means.

This comprehensive teaching design can not only allow students to experience the entire construction process of innovative thinking at multiple levels, but also guide them to realize the sense of achievement brought by thinking collision and creation in practice.

5. Conclusion

The arrival of the new productive force's era puts forward higher requirements for the general technology curriculum in ordinary senior high schools. This paper discusses the curriculum optimization path from four aspects: project-based learning (PBL), strengthening of practice links, STEAM interdisciplinary integration and diversified evaluation system, aiming to improve students' innovative consciousness and technical application ability through real project tasks, hands-on operation, interdisciplinary learning and multi-dimensional evaluation. In the future, curriculum reform should further strengthen resource integration, introduce enterprise cooperation, social practice projects and other ways to provide students with richer learning experience, so as to better cultivate high-quality innovative talents meeting the needs of the new era.

Disclosure statement

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Research on Innovation of Blended Teaching Mode in Comprehensive Practical Training Course of Financial Accounting in Colleges and Universities

Yunfeng Wang*

Joint Logistics Support Force Engineering University, Chongqing 400000, China

**Author to whom correspondence should be addressed.*

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Abstract: Against the backdrop of the digital era, profound changes have taken place in the education industry. The development of information technology has affected the teaching of financial accounting majors in colleges and universities. The traditional teaching mode can hardly meet the needs of talent cultivation. Therefore, in the comprehensive practical training course of financial accounting, it is necessary to attach importance to the implementation of blended teaching, effectively innovate the teaching mode, and improve the effectiveness of talent cultivation. From the perspective of the comprehensive practical training course of financial accounting in colleges and universities, this paper analyzes the application value of blended teaching and puts forward specific teaching practice strategies, aiming to enhance the educational effect of the course and provide reference for the subsequent reform of professional courses.

Keywords: Colleges and universities; Comprehensive practical training course of financial accounting; Blended teaching

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1. Introduction

In the financial accounting industry, students are required to have good practical and comprehensive qualities. Among them, blended teaching activities can meet the needs of comprehensive practical training of financial accounting in colleges and universities and provide students with personalized learning experiences. In the teaching practice of colleges and universities, the application of practical simulation cases helps to improve students' practical skills and cultivate their teamwork ability. Among them, colleges and universities need to clarify the advantages of blended teaching and carry out a series of innovative reforms, so as to integrate more innovative elements into the practical training curriculum system and effectively improve the effectiveness of

talent cultivation.

2. The application value of blended teaching mode in the comprehensive training course of financial accounting in colleges and universities

2.1. Enhancing learning autonomy

Blended teaching helps break through the limitations of time and space, making it convenient for students to participate in learning on online platforms according to their own needs, freely choose learning content, and reasonably plan their study time ^[1]. In the comprehensive training course of financial accounting in colleges and universities, students can engage in online courses to continuously learn financial accounting theoretical knowledge, familiarize themselves with practical operation procedures, and review teaching videos repeatedly to deeply understand the knowledge content ^[2]. At the same time, students can make good use of online platforms to carry out practice activities, effectively test their learning results, identify potential problems, and thus effectively improve their learning autonomy.

2.2. Enriching teaching resources

Online teaching platforms contain rich teaching resources, such as videos and case libraries. The expansion of these resources can provide abundant teaching materials for the implementation of financial accounting training courses in colleges and universities ^[3]. Teachers can select appropriate resources based on teaching content and students' situations, adjust teaching activities, and effectively expand teaching content. For example, by introducing corporate financial accounting cases, students can understand the workflow of corporate financial accounting, identify potential problems, effectively broaden their horizons, and cultivate their knowledge application skills.

2.3. Strengthening teacher-student interaction

In the traditional teaching of comprehensive financial accounting training courses, teacher-student interaction is usually limited by time and space, resulting in insufficient actual interaction opportunities. However, the implementation of blended teaching can give play to the role of online platforms, providing a good carrier for teacher-student interaction. When students encounter problems in the process of learning, they can ask teachers for help through online platforms at any time, and teachers can provide timely answers and guidance ^[4]. In addition, online platforms often support group discussion activities between teachers and students, which can strengthen teacher-student communication and help improve the effect of teacher-student interaction.

2.4. Improving learning effect through personalized feedback and guidance

The construction of online learning platforms can effectively record students' learning data, and the implementation of blended teaching can help teachers have a clearer understanding of students' situations ^[5]. Teachers can provide students with personalized feedback and guidance based on data information, so as to effectively meet their learning needs. The implementation of customized teaching guidance can not only help students understand and master financial accounting knowledge, but also help improve learning efficiency. Through real-time feedback activities, students can choose appropriate learning strategies, efficiently complete training activities, and thus achieve good learning results.

3. Practical strategies for the blended teaching model in college financial accounting comprehensive training courses

3.1. Implementing group project cooperation

First, conduct scientific and reasonable group division activities. In the process of group project cooperation, teachers need to understand the students' situation and divide them into groups reasonably. Teachers can consider various factors such as academic performance and personality traits to divide students into different groups, ensuring that the abilities and characteristics of members in each group are complementary^[6]. Generally speaking, each group has 4–5 members. Some members in the group have a strong theoretical foundation, while others have strong practical skills, which can effectively carry out communication and coordination. Such a combination can ensure the smooth implementation of group projects.

Second, attach importance to clarifying project tasks. Teachers can formulate scientific and reasonable project-based tasks according to the situation of members in each group. These project tasks can be combined with the objectives and contents of college financial accounting training courses to enhance the effectiveness of the tasks^[7]. For example, teachers can simulate enterprise financial accounting work and set project tasks involving various types of work, such as the preparation of accounting vouchers, registration of account books, and production of financial statements^[8]. At the same time, teachers can explain the project requirements and clarify standards such as time and evaluation criteria, helping students clearly understand the practical practices they need to adopt.

Third, actively carry out online and offline cooperation activities. In the face of the implementation of group projects, teachers need to pay attention to giving play to the advantages of blended teaching and encourage students to carry out online and offline cooperation. In offline classes, students can communicate and analyze with each other, formulate scientific project plans, reasonably arrange work tasks, and effectively solve various problems arising during project implementation^[9]. On online platforms, students can use network platforms to carry out activities such as data collection and information sharing. For example, the application of online document tools can help edit good financial statements, and communication software can be used to analyze the situation of project communication. Teachers need to pay attention to the progress of group projects and provide scientific and reasonable guidance for them, so that students can learn from each other and make progress through cooperation.

3.2. Effectively simulating practical operation links

First, attach importance to the construction of virtual training environments. To help students experience the workflow of financial accounting, teachers need to build a sound virtual training environment in combination with the actual situation of enterprise positions, enhance the use of on-campus financial accounting training rooms, and equip them with hardware facilities and software that are in line with enterprise job scenarios, such as accounting vouchers, financial statements and other materials^[10]. At the same time, the application of multimedia technology, AR technology, etc., can create a good financial work scene, facilitate students to understand the business process, enable them to personally experience the enterprise environment, and carry out good training operations.

Second, design diversified training projects. In the teaching of financial accounting training courses, teachers need to grasp the teaching objectives, clearly understand the needs of enterprise financial accounting work, and design a variety of training projects. These training projects should cover different links of financial accounting work, such as basic accounting calculation, tax accounting calculation, etc. For example, in the training process of basic accounting calculation, teachers can set up daily economic business processing tasks in

combination with enterprise cases to encourage students to actively participate in the training, understand sales business, reimbursement business, etc., master more professional skills, improve their employability, and lay a foundation for their subsequent engagement in financial accounting-related work.

Third, promote the organic integration of online teaching guidance and offline practical operations. In the practical operation session carried out by students, teachers need to pay attention to the organic integration of online and offline, create a good education environment, and effectively improve the effectiveness of education. For example, students can participate in the financial accounting professional training room to carry out offline operation activities, and teachers need to conduct on-site inspections and guidance, clearly understand the problems in students' practical operations, and provide scientific guidance opinions^[11]. At the same time, when students encounter various problems in practical operations, they can use online platforms to consult teachers in a timely manner, and teachers can carry out good remote guidance through video, voice and other forms. In addition, teachers can also use online platforms to display the key and difficult points in training operations and produce corresponding operation demonstration videos, which is convenient for students to participate in case analysis activities, helps them intuitively understand the content of practical operations, and enables them to form good professional capabilities.

3.3. Organize online interactions regularly

First, clarify the theme of online interactions. Teachers should focus on the regular implementation of online interactions and clarify the theme of the activity. When choosing the theme of interaction, teachers need to combine the situation of the comprehensive training course in financial accounting of colleges and universities, grasp the teaching content, and identify the problems encountered by students in the process of knowledge learning^[12]. For example, in the face of difficult problems in financial accounting, such as the calculation of fixed, asset depreciation, teachers can set up corresponding special topic discussions, identify the problems in students' practical training operations, such as the insufficient standardization of voucher filling, ledger registration, etc., and actively carry out experience including sharing activities. Through the setting of good interaction themes, the quality of online interactions can be improved, and good educational results can be achieved.

Second, attach importance to the selection of interaction platforms. Teachers can understand the interaction situation and students' usage habits, so as to select a good interaction platform. In the current era background, common interaction platforms include WeChat, QQ, and DingTalk, etc. Teachers can use the WeChat official account to release teaching consultations^[13]. At the same time, they can use the DingTalk group to carry out file sharing, organize video conferences, and conduct good online group communication activities to effectively answer questions. The use of online teaching platforms is helpful for the improvement of teaching activities, which facilitates teachers to select good platforms according to different practical training contents, closely communicate with students, and effectively improve the effectiveness of education.

Third, actively carry out interaction and communication activities. In the process of choosing the interaction theme and platform, teachers need to proceed from the perspective of students and organize them to actively participate in interaction and communication. Teachers can combine the interaction platform to promptly issue notifications and materials related to the interaction to help students prepare well. Starting from the specific interaction links, teachers need to attach importance to giving play to their leading role, encourage students to participate in the communication and discussion process, and effectively express their own views and opinions. For example, in the specific special such as topic discussion session, teachers can promptly put

forward questions and encourage students to participate in analysis and communication.

3.4. Conducting real-time feedback and evaluation

First, attach importance to the optimization of the feedback mechanism. The establishment of a scientific feedback mechanism is conducive to the implementation of real-time feedback and evaluation. Teachers can use online platforms to grasp data such as learning records and test scores, so as to clearly understand students' knowledge learning situation. At the same time, teachers need to encourage students to identify the problems they encounter in their knowledge learning through online questionnaires, messages and other forms ^[14]. Colleges and universities should organize student mutual evaluation activities, allowing students to evaluate each other, understand their learning achievements and performance in financial accounting, and facilitate mutual supervision and progress.

Second, actively carry out process-oriented evaluation activities. Process-oriented evaluation covers the entire financial accounting training course and plays a crucial role. Teachers need to regularly check students' knowledge learning situation, such as online learning participation, project completion, and practical performance. For example, teachers can understand the duration of students' viewing of learning videos and the completion of homework, so as to effectively evaluate students' online learning situation. Teachers can also check group projects, understand the project progress and results, and scientifically and reasonably evaluate students' team and practical skills. By testing students' practical operation process, we can clearly understand their mastery of financial accounting knowledge and skills. Based on the evaluation results, teachers can identify the possible problems of students, effectively improve teaching countermeasures, and provide personalized learning guidance for students.

Third, actively implement summative evaluation. After the completion of the financial accounting training course, emphasis can be placed on the implementation of summative evaluation activities. In the process of summative evaluation, teachers can adopt methods such as examinations and project achievement displays to understand students' knowledge learning results and conduct a comprehensive evaluation ^[15]. The final examination can adopt a combination of theory and practice to focus on examining students' mastery of financial knowledge. The display of project results and the writing of training reports can clearly reflect students' comprehensive practical skills. The implementation of summative evaluation activities can help understand students' knowledge learning situation, carry out comprehensive evaluation activities, provide a guarantee for course performance evaluation, and facilitate teachers to adjust teaching activities.

4. Conclusion

To sum up, in the process of blended teaching in colleges and universities, it is necessary to attach importance to the construction of infrastructure, effectively stimulate students' internal motivation, and strengthen teachers' counseling efforts. The quality of blended teaching can be effectively improved through measures such as organizing online learning resources, conducting case studies, and implementing feedback and evaluation. Against the backdrop of the information age, when teachers in colleges and universities actively carry out blended teaching in the comprehensive practical training course of financial accounting, it can effectively meet the needs of students' development and lay a foundation for their healthy career development in the future.

Disclosure statement

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A Study on Applying the BOPPPS Teaching Model to Improve English Reading Skills of Junior High School Students in Fujian, China

Dingchang Wang^{1*}, Feifei Chen²

¹Chinese International College, Dhurakij Pundit University, Bangkok 10210, Thailand.

²Chinese International College, Dhurakij Pundit University, Bangkok 10210, Thailand / Faculty of Sports Science, Ningbo University, Ningbo 315000, China

**Corresponding author: Dingchang Wang, 18606969756@163.com*

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Abstract: This study investigated the effectiveness of the BOPPPS teaching model in improving English reading skills among junior high school students in Fujian Province, China. Using a quasi-experimental design, 102 ninth-grade students from two classes participated: an experimental group ($n = 51$) taught with BOPPPS for 12 weeks (12 sessions) and a control group ($n = 51$) receiving traditional instruction. The A2 Key for Schools test measured reading ability pre- and post-intervention. Data analysis (independent/paired t-tests, ANCOVA) revealed that students in the BOPPPS group showed significantly greater improvement in English reading ability compared to the control group. The findings indicate the BOPPPS model is well-suited for developing junior high English reading curricula to enhance student proficiency.

Keywords: BOPPPS teaching model; Junior high school student; Reading ability

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1. Introduction

1.1. Research background

In today's globalized world, the importance of English is self-evident. As a global lingua franca, English is indispensable in educational settings. It not only enhances communication but also serves as a tool for driving social progress. Many non-English speaking countries are actively promoting its learning^[1]. In China, English education has become a crucial component of the national education system. Many believe that mastering English plays a vital role in China's access to the international stage and in building a community with a shared future for mankind. Reading is the primary channel for language input; learning any language is inseparable from extensive reading. English reading is a particularly important way for students to learn English. Through reading, students can acquire language knowledge, develop language proficiency, cultivate cultural awareness, enhance thinking quality, and improve learning ability. Within the educational sphere, English reading not only

constitutes a core part of language mastery but also becomes a key pathway for enhancing students' cross-cultural communication skills and critical thinking abilities.

Chinese junior high school students face several challenges in English reading. First, long-term immersion in a non-English environment limits natural language acquisition, and insufficient cultural knowledge hinders comprehension. Second, limited vocabulary, unclear word meanings, and weak grammar make it hard to understand complex texts, causing frustration, reducing motivation, and affecting exam performance ^[2]. Finally, English reading instruction is heavily exam-oriented, with teachers often relying on lecture-based, text-parsing, and reading-aloud methods. This “spoon-feeding” approach keeps students largely passive in learning ^[3].

Research in the field of physiology has found distinct differences between males and females in cognitive abilities and learning methods. These differences are reflected in their cognitive development and variations in higher brain functions ^[4].

In summary, this study aims to investigate the impact of the BOPPPS teaching model on junior high school students' English reading ability. By analyzing the implementation of the BOPPPS model and the influence of background variables such as gender and grade level on English reading ability, it will provide empirical support and suggestions for teaching strategies to enhance junior high school students' English reading proficiency.

2. Discussion on the concept of “BOPPPS teaching model” and “English reading ability”

2.1. BOPPPS teaching model

The BOPPPS teaching model was initially developed by the Canadian Instructional Skills Workshop (ISW) for teacher certification in British Columbia, Canada, primarily for teacher skill training. The BOPPPS model places particular emphasis on teaching interaction and feedback, comprising the following six stages: Bridge-in, Objective, Pre-assessment, Participatory Learning, Post-assessment, and Summary. The acronym BOPPPS is formed from the initial letters of each stage for ease of memorization.

In the Bridge-in phase, teachers connect new content to students' prior knowledge or future challenges, ensuring relevance. Learning Objectives guide and motivate both teaching and learning, and form the basis for evaluation. Pre-assessment checks students' prior knowledge. Participatory Learning, the core of BOPPPS, promotes active student engagement. Post-assessment determines if objectives are met. Summary consolidates key points, clarifies knowledge, and previews the next lesson.

Previous study contended that the BOPPPS model helps teachers better introduce content to students through clear articulation of learning objectives and pre-assessment, and aids students in better understanding knowledge through summary and post-assessment ^[5]. He stressed that pre-assessment and post-assessment are two main phases that teachers should highly prioritize. There is also a study has described an online Russian teaching method based on the BOPPPS model, applied during the COVID-19 quarantine period, which promoted improvements in the online teaching process and assessment system ^[6]. By applying the BOPPPS model to engineering education, demonstrating through experimentation that it is an effective teaching model for enhancing both teaching quality and student learning capabilities ^[7].

2.2. English reading ability

Richards and Schmidt view reading ability as the extent to which readers can utilize reading skills during the reading process, essentially how effectively they read. Some Chinese scholars offer different interpretations of English reading ability, placing greater emphasis on English reading comprehension skills ^[8]. The Organization

for Economic Co-operation and Development (OECD) in 2019 states that reading ability includes skills such as language use, problem-solving, and communication ^[9]. It is an important predictor of students' future development, a measure of student development level within educational quality and equity, and is considered by many researchers as a core variable in educational achievement assessment. English reading ability permeates the entire process of junior high school English learning; consequently, improving it is also regarded as one of the tasks of school education.

2.3. The relationships between “BOPPPS teaching model” and “English reading ability”

There is study that explored the application of the BOPPPS teaching model in college English reading instruction ^[10]. They argued that this model can effectively design university-level English reading courses, promoting students' improvement in language skills, linguistic knowledge, learning strategies, and cultural awareness, thereby enhancing their English reading ability. Zhang et al. took the text “The Voyages of Zheng He” from Unit 1 of the ninth-grade (second semester) Shanghai Edition English textbook as an example ^[11]. They demonstrated how to guide students from extracting information, analyzing and processing it to forming their own understanding and perspectives through specific teaching activity designs, thereby improving students' English reading ability and thinking quality. Throughout the teaching process, teachers emphasized setting clear, specific teaching objectives based on students' actual learning situations and designing interconnected teaching activities to ensure these activities effectively promote the development of students' thinking quality and achieve the teaching goals.

The BOPPPS teaching model has been applied at various educational levels and is closely linked to improving English reading ability. Studies show it effectively enhances reading comprehension, cultural awareness, and linguistic knowledge. Moreover, it shifts students from passive readers to active learners, supporting their long-term language development.

3. Theoretical framework of “BOPPPS teaching model and English reading ability”

This study employed a quasi-experimental approach to investigate the effects of the BOPPPS teaching model on Chinese junior high school students' English reading ability. Both the experimental and control groups underwent pre- and post-tests using the 2022 Cambridge English A2 Key for Schools Reading and Writing Sample Test as the research instrument. Purposive sampling was utilized, selecting two intact classes totaling 102 students (Class A: n = 51; Class B: n = 51). One class was designated as the experimental group and received a 12-week instructional intervention comprising 12 English reading lessons (45 minutes per lesson). The post-test was administered immediately after the final session in Week 12. Comparative analysis of pre-test and post-test data from both groups was conducted to examine the impact of implementing the BOPPPS model in junior high English reading instruction. **Figure 1** illustrates the experimental research framework.

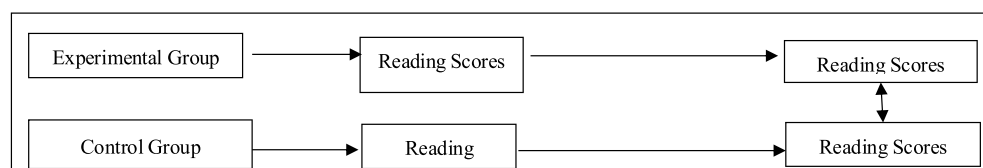


Figure 1. Experimental research framework.

4. Result

4.1. Independent sample t-test of EC and CC students

In order to investigate whether there was a difference in English reading ability between the control group and the experimental group before the experiment, an independent samples *t*-test was conducted on the pre-test scores of the two groups. As shown in **Table 1**, the *t*-value for reading ability was -1.201 ($p > .050$), which did not reach a significant level, indicating that there was no statistically significant difference between the two groups. This suggests that, prior to the experiment, the reading abilities of the experimental group and the control group were at the same level. Therefore, it can be concluded that both groups had consistent initial levels before the intervention, making the experiment feasible.

Table 1. Pre-test independent samples *t*-test

Dimension	Groups	N	M	SD	t	Sig
Reading Scores	EC	51	13.294	4.850	-1.201	.233
	CC	51	14.392	4.373		

In order to examine whether there was a significant difference in English reading ability between the control group and the experimental group after the experiment, an independent samples *t*-test was conducted on the post-test results of the two groups. As shown in **Table 2**, the comparison of English reading ability yielded a *t*-value of 2.91 ($p < .050$). The experimental group ($M = 23.569$) scored significantly higher in English reading ability than the control group ($M = 21.490$). This indicates that there was a significant difference between the experimental group and the control group after the experiment. Therefore, it can be concluded that the BOPPPS teaching model was more effective in improving junior high school students' English reading ability than the traditional teaching model used in the control group.

Table 2. Post-test independent samples *t*-test

Dimension	Groups	N	M	SD	t	Sig
Reading Scores	EC	51	23.569	3.534	2.91	.004
	CC	51	21.490	3.679		

4.2. The t-test of paired samples

As shown in **Table 3**, the English reading ability of the experimental group ($t = -22.040$, $p < .050$) increased from a pre-test mean (*M*) of 13.294 to a post-test mean (*M*) of 23.569, with an average improvement of 10.275. This indicates that the use of the BOPPPS teaching model effectively enhanced the English reading ability of the experimental group students. For the control group ($t = -18.826$, $p < .050$), the English reading ability improved from a pre-test mean (*M*) of 14.392 to a post-test mean (*M*) of 21.490, with an average improvement of 7.098. This significant increase suggests that the traditional teaching method also contributed to improving students' English reading ability.

Table 3. Paired samples *t*-test for pre- and post-test results of the two groups

Groups	Stage	N	M	SD	t	Sig
EC	Pre-test	51	13.294	4.850	-22.040	.000
	Post-test		23.569	3.534		
CC	Pre-test	51	14.392	4.373	-18.826	.000
	Post-test		21.490	3.679		

4.3. Covariance analysis

The test for the interaction between group and pre-test scores yielded an *F*-value of 1.702, $p = .192$ ($>.050$), which did not reach a significant level. This indicates that the relationship between pre-test and post-test scores did not differ across treatment levels, and the assumption of homogeneity of regression slopes was met, allowing for ANCOVA to be conducted.

The results of the ANCOVA are presented in **Table 4**. The pre-test English reading ability had an *F*-value of 9.283, $p = .003$ ($p < .010$), indicating that the pre-test had a significant predictive effect on the post-test and could influence the post-test scores. After controlling for the effect of the pre-test, the *F*-value was 134.311, $p = .000$ ($p < .001$), showing that the post-test scores of the experimental group were significantly higher than those of the control group. In summary, these results demonstrate that the BOPPPS teaching model can effectively improve students' English reading ability.

Table 4. Analysis of one-way ANCOVA of English reading ability

Dimension	Sources	SS	df	MS	F	p
Reading Scores	Pre-test	742.818	1	742.818	9.283	.003
	Group	186.862	1	186.862	134.311	.000
	Error	558.437	99	5.641		

5. Retrospect and prospect

Small sample size. The limited number of participants may reduce the objectivity and representativeness of the findings. Future studies should recruit from more schools, ideally on a national scale, to obtain larger and more diverse samples and enhance the reliability and generalizability of results.

Short experimental period. Second language acquisition is a gradual process that requires time. The short duration in this study may have constrained the full effect of the BOPPPS model. Extending the intervention period, together with increasing the sample size, would allow for a better understanding of its impact and provide stronger empirical support.

Disclosure statement

The authors declare no conflict of interest.

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Innovation and Practice of Corporate Financial Audit in the Context of Modern Education

Jue Wang, Xiaoji Ma*

Zhongkai University of Agriculture and Engineering, Guangzhou 510225, Guangdong, China

**Author to whom correspondence should be addressed.*

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Abstract: With the development of modern educational concepts and technologies, corporate financial audit is facing unprecedented challenges and opportunities. This paper first analyzes the new characteristics of corporate financial audit in the context of modern education, including the widespread application of digital audit tools, the diversification of audit content, and the increased requirements for audit efficiency. Then, it explores the innovative practices in corporate financial audit, such as the introduction of big data analysis technology, the construction of intelligent audit platforms, and the implementation of continuous audit. The paper also conducts an in-depth study on the impact of these innovative practices on the processes, quality, and risk management of corporate financial audit. Finally, it summarizes the effectiveness of the innovation and practice of corporate financial audit in the context of modern education, and looks forward to future development trends, providing references for theoretical research and practical operations in related fields.

Keywords: Modern education context; Corporate financial audit; Innovative practice; Big data analysis; Intelligent audit; Continuous audit

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1. Introduction

With the widespread application of digital and intelligent technologies, the traditional audit model is gradually transforming towards a more efficient and accurate direction^[1]. This paper explores the impact of the modern education context on corporate financial audit, analyzes the effectiveness of audit innovation practices, and looks forward to future development trends. Through in-depth research, we aim to provide valuable references for theoretical research and practical operations in related fields, and promote the development of corporate financial audit to a higher level in the context of modern education.

2. New characteristics of corporate financial auditing in the context of modern education

2.1. Popularization and impact of digital auditing tools

With the rapid development of information technology, digital auditing tools have gradually become standard in the field of corporate financial auditing. These tools not only significantly improve the efficiency of data processing but also identify risk points that are difficult to detect through traditional auditing methods via algorithmic models. The popularization of digital auditing tools enables auditors to complete audit tasks more quickly and accurately, while also placing higher demands on their digital skills ^[2]. In addition, the application of digital auditing tools has promoted the standardization and automation of audit processes, further enhancing the transparency and standardization of audit work.

2.2. Diversified development of audit content

In the context of modern education, profound changes are occurring in the content of corporate financial auditing. Beyond traditional financial statement auditing, auditors now need to focus on multiple aspects such as corporate internal controls, risk management, and business processes ^[3]. This diversified development of audit content requires auditors to possess a broader knowledge background and more comprehensive skills. Meanwhile, as corporate business models continue to innovate and become more complex, audit content is constantly expanding and deepening, posing higher challenges to auditors' professional capabilities and innovative thinking ^[4].

2.3. Increased requirements for audit efficiency and associated challenges

In the context of modern education, enterprises are placing increasingly high demands on the efficiency of financial auditing. On one hand, enterprises need to promptly identify and rectify issues through auditing to maintain stable operations; on the other hand, fast and efficient auditing can help enterprises save costs and enhance competitiveness. However, improving audit efficiency is no easy task. Auditors must continuously optimize audit processes and improve efficiency while ensuring audit quality. At the same time, as enterprises expand in scale and their business complexity increases, the difficulty of audit work continues to rise, placing higher demands on auditors' professional abilities and team collaboration skills ^[5]. Therefore, how to improve audit efficiency while ensuring quality has become a key challenge for modern corporate financial auditing.

3. Innovative practices in corporate financial audit

3.1. Application of audit with the introduction of big data analysis technology

3.1.1. The role of big data technology in audit data collection and processing

With the rapid development of information technology, the application of big data technology has become a major trend in the audit field. In terms of audit data collection, big data technology can quickly integrate massive amounts of data from different sources and in different formats through efficient data capture and storage mechanisms, thereby ensuring the comprehensiveness and accuracy of audit data ^[6]. This method of audit data collection and processing based on big data has significantly improved the efficiency and quality of audit work.

3.1.2. The application of data analysis models in audit risk assessment

Data analysis models are another important application of big data technology in the audit field. These models

can be customized and optimized based on historical data, industry data, and the specific situation of the audited entity to provide more accurate and personalized audit risk assessment results. This not only helps auditors identify potential risks and problems but also provides management with targeted improvement suggestions, further enhancing the value and influence of audit work.

3.2. Construction and implementation of intelligent audit platform

3.2.1. Functions and characteristics of intelligent audit platform

The intelligent audit platform is another important achievement of technological innovation in the audit field. By integrating advanced technologies such as big data and artificial intelligence, the platform realizes the intellectualization and automation of audit work. Specifically, the intelligent audit platform has the following functions and characteristics: Firstly, it has strong data processing and analysis capabilities, which can automatically complete tasks such as data collection, cleaning, classification, and mining; Secondly, the platform also has a variety of built-in audit models and algorithms, which can automatically conduct risk assessment and anomaly detection; Finally, the platform also provides a wealth of visualization tools and report generation functions, facilitating auditors to intuitively display audit results and put forward suggestions. These functions and characteristics make the intelligent audit platform an important tool to improve the efficiency and quality of audit work.

3.2.2. The role of the platform in improving audit efficiency and quality

The intelligent audit platform plays an important role in improving audit efficiency and quality^[7]. Firstly, through automated and intelligent data processing and analysis functions, the platform can significantly reduce the time cost of manual operations and data processing, improving the efficiency of audit work. Secondly, the various built-in audit models and algorithms of the platform can automatically conduct risk assessment and anomaly detection, helping auditors more accurately identify problems and risk points, and improving the quality of audit work. In addition, the platform also provides a wealth of visualization tools and report generation functions, making audit results more intuitive and easier to understand, and providing management with clearer and more useful decision-making basis. These advantages together promote the overall improvement of audit work efficiency and quality.

3.3. Practice and development of continuous auditing

3.3.1. Concept and process of continuous auditing

Continuous auditing is a new type of auditing method, whose concept is “real-time monitoring, continuous evaluation, and timely response”. It aims to identify potential risks and issues by real-time data acquisition and analysis, and take corresponding improvement measures promptly^[8]. In practice, the process of continuous auditing usually includes steps such as defining audit objectives, designing audit plans, collecting and analyzing data. These steps need to be carried out cyclically to ensure continuous attention and monitoring of the audited entity’s financial status and internal controls.

3.3.2. Application of continuous auditing in risk monitoring and management

Continuous auditing plays an important role in risk monitoring and management. It helps management promptly identify potential risks and issues, and take corresponding improvement measures to reduce risks. This real-time monitoring-based risk management approach enables management to understand the enterprise’s operational status and potential risk points timelier and accurately, thereby making more informed and effective decisions.

Meanwhile, continuous auditing can also provide ongoing risk assessment and improvement suggestions, helping management continuously improve the internal control system and enhance risk management capabilities. These advantages make continuous auditing one of the important tools for risk monitoring and management in modern enterprises.

4. Impact of innovative practices on corporate financial auditing

4.1. Optimization and reengineering of audit processes

With the continuous advancement of technology and the increasing complexity of audit demands, the optimization and reengineering of audit processes have become crucial. Traditional audit processes often focus on post-event auditing, which is difficult to meet modern enterprises' needs for risk prevention and real-time monitoring. Therefore, optimizing audit processes requires introducing advanced technical means to realize the pre-positioning and continuity of audit work. The application of automated tools can reduce manual operations, improve audit efficiency, and ensure the accuracy and completeness of data. In addition, reengineering audit processes also needs to focus on the rational allocation of audit resources to ensure the comprehensiveness and depth of audit work. By optimizing audit processes, not only can the efficiency and quality of audit work be improved, but also enterprises' risk management needs can be better met.

4.2. Improvement and assurance of audit quality

Audit quality is the lifeline of audit work, which is related to the healthy development of enterprises and the protection of investors' interests. Improving audit quality requires efforts from multiple aspects. Firstly, it is necessary to strengthen the professional quality and professional ethics education of auditors to ensure they have solid professional knowledge and good professional ethics. Secondly, it is necessary to improve audit standards and norms to provide clear guidance and basis for audit work^[9]. In addition, advanced technical means should be introduced to enhance the technological content and accuracy of audit work. At the same time, supervision and evaluation of audit work should be strengthened to promptly identify and correct problems and deficiencies in audit work^[10]. Through the implementation of these measures, audit quality can be effectively improved, investors' legitimate rights and interests can be protected, and the healthy development of enterprises can be promoted.

4.3. Strengthening and innovation of audit risk management

Audit risk management is an important part of audit work, which is of great significance for preventing and resolving audit risks. With the expansion of enterprise scale and the complexity of business, audit risk management is facing unprecedented challenges. Therefore, it is imperative to strengthen audit risk management. On the one hand, it is necessary to establish a sound audit risk management system and mechanism, and clarify the risk management responsibilities and authorities of audit institutions and personnel at all levels. On the other hand, advanced technical means and methods should be introduced to improve the scientificity and effectiveness of audit risk management. Meanwhile, attention should be paid to innovating audit risk management methods and approaches, and continuously exploring audit risk management paths suitable for the actual situation of enterprises. Through the implementation of these measures, audit risk management can be strengthened, audit risks can be effectively prevented and resolved, and the stable operation and sustainable development of enterprises can be guaranteed.

5. Analysis of the effectiveness of innovation and practice in corporate financial auditing in the context of modern education

5.1. Specific achievements of innovative practices in enhancing audit efficiency and quality

The application of innovative practices in the auditing field has yielded remarkable results. Firstly, in terms of improving audit efficiency, the introduction of advanced technical tools and methods has significantly enhanced the efficiency of audit work. Secondly, innovative practices have also played a crucial role in improving audit quality. Additionally, measures such as involving external experts and strengthening internal training have improved the professional competence and comprehensive capabilities of auditors, providing strong support for enhancing audit quality.

5.2. Challenges and problems faced

Despite the significant achievements in improving audit efficiency and quality through innovative practices, a series of challenges and problems remain. Firstly, the rapid pace of technological upgrading requires auditors to continuously learn and master new technologies to adapt to the evolving work environment ^[11]. However, due to heavy workloads and time pressures, auditors often struggle to allocate sufficient time for technical learning and training. Secondly, data security and privacy protection are critical issues in auditing. When using technologies such as big data for auditing, ensuring data security and privacy is an urgent problem to be solved ^[12]. Furthermore, innovative practices have brought new risks and challenges, such as technical failures and data errors, which require auditors to pay attention to and prevent in their work. Therefore, while promoting innovative practices, it is necessary to address these challenges and problems with corresponding measures.

6. Future development trends and prospects

6.1. The sustained impact of modern education and technology on the development of financial auditing

With the rapid development of modern education and technology, the field of financial auditing has also been profoundly influenced. Modern education has cultivated a large number of talents with high professional literacy and skills in the financial auditing field, who not only master solid theoretical knowledge of auditing but also possess proficient technical operation capabilities. Meanwhile, continuous technological innovation has provided more efficient and accurate tools and methods for financial auditing. Therefore, the sustained development of modern education and technology provides a constant driving force for the progress of the financial auditing field.

6.2. Future innovation directions and practical strategies for corporate financial auditing

Looking ahead, the innovation directions and practical strategies for corporate financial auditing will focus on the following aspects: Firstly, strengthening technological innovation by actively introducing and applying new technologies and methods such as artificial intelligence and blockchain to improve audit efficiency and accuracy; Secondly, emphasizing data analysis by in-depth mining and analyzing corporate data to identify potential risks and issues, thereby providing more valuable suggestions for enterprises; Thirdly, strengthening risk-oriented auditing to determine audit priorities and directions based on risks, better serving enterprise risk management; Fourthly, enhancing team building to cultivate auditing talents with high professional quality and skills, providing strong support for the sustainable development of enterprises ^[13,14].

6.3. Insights and suggestions for theory and practice in related fields

The sustained impact of modern education and technology on the development of financial auditing, as well as the future innovation directions and practical strategies for corporate financial auditing, provide profound insights and suggestions for theory and practice in related fields. On the one hand, attention should be paid to the application of modern education and technology in the financial auditing field, and efforts should be made to strengthen the cultivation of related talents and technological innovation to adapt to the evolving work environment; On the other hand, emphasis should be placed on integrating theory with practice, continuously exploring and innovating financial auditing methods and means to provide strong support for the healthy development of enterprises. Meanwhile, it is necessary to strengthen international cooperation and exchanges, learn from international advanced experiences and technologies, and promote the international development of the financial auditing field^[15].

7. Conclusion

In summary, the integration of modern education and technology has brought significant changes to corporate financial auditing, improving efficiency and quality, and promoting the innovation of auditing methods. Looking forward, corporate financial auditing will continue to embrace advanced technologies, strengthen risk management and internal control, and achieve a higher level of intelligence and automation. This field is full of opportunities, and continuous innovation and greater contributions are expected in the future.

Disclosure statement

The authors declare no conflict of interest.

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The Impact of Pre-Task Planning Intervention on Learners' Oral Communication: A Study Based on the Controlled Experiment Method

Balihaxi Muheyati¹, Maoqiong Liu^{2*}

¹School of International Economics and Trade, Xinjiang University of Finance and Economics, Urumqi 830012, Xinjiang, China

²School of Foreign Languages, Qiongtai Normal University, Haikou 571127, Hainan, China

**Author to whom correspondence should be addressed.*

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Abstract: The “Belt and Road” initiative has led to a diversified and increasing demand for international talents, signifying that current foreign language teaching needs to promote the integration and interaction of online and offline methods, deeply reform classrooms, and innovate learner-centered teaching models. A survey of the language abilities of university students at 9 border-region institutions revealed that oral expression skills were the weakest among the five measured dimensions: listening, speaking, reading, writing, and translation. Given this situation, this study employed a controlled experiment to explore and analyze the impact of pre-task planning intervention on students' learning attitudes, learning strategies, and oral communication abilities, aiming to provide insights for improving overall oral communication teaching.

Keywords: Pre-task planning; Learning strategies; Oral communication

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1. Introduction

Oral communication competence is an individual's comprehensive ability to use spoken language for effective communication, encompassing aspects such as pronunciation, grammar, vocabulary, fluency, and comprehension ^[1]. In language proficiency assessments of university students in border regions, oral expression ability is the weakest area. The enhancement of their oral communication competence primarily relies on the effective allocation of educational resources, culturally sensitive teaching methods, and language practice ^[2]. Pre-task planning plays a crucial role in language learning. Through systematic preparation and strategy deployment, it helps students build necessary confidence and competence before actual language use, enabling them to participate more effectively in oral communication.

Pre-task planning intervention is a teaching strategy designed to help students engage in sufficient thinking

and preparation before the actual execution of a task through systematic groundwork and planning ^[3]. This strategy typically includes previewing learning content, discussing and planning strategies, and predicting potential challenges along with formulating solutions. Pre-task planning intervention can enhance students' self-efficacy and improve learning efficiency ^[4]. Furthermore, this strategy promotes the development of critical thinking and problem-solving abilities. By training through simulated real communication scenarios, students can better cope with authentic language communication environments, thereby significantly improving their oral fluency and language accuracy.

Currently, research on pre-task planning is limited, especially concerning its impact on university students' English oral communication ^[5]. Overseas research, represented by Robinson and Skehan, laid the foundation for studies on task complexity and planning. Ellis's identification of subtypes of pre-task planning provides a basis for this study ^[6]. Li Jiu and Wang Jianhua has explored the impact of pre-task planning time and task constraints on second language writing performance ^[7]. Domestic research has primarily focused on written language output, with less emphasis on oral output ^[8]. Although previous studies found that pre-task planning can enhance fluency and complexity of language expression, they neglected the impact of pre-task planning intervention on students' learning attitudes, learning strategies, and oral communication abilities.

Therefore, this study, through a two-semester controlled experiment and employing quantitative and qualitative research methods, explores the correlation between pre-task planning and oral communication, thereby providing effective pathways to enhance learners' oral communication competence, aiming to offer insights for improving overall oral communication teaching.

2. Controlled experiment design

The subjects were two groups of students from the 2024 cohort at universities in Xinjiang, with 44 students in each group, as shown in **Table 1**. The experimental group adopted blended online-offline teaching, formative assessment, collaborative learning, and teaching strategies based on the China Standards of English Language Ability (hereinafter referred to as CSE). The control group continued with traditional teaching methods ^[9].

Table 1. Details of experimental subjects

Group	Teaching Methods	Number of Students
Experimental	Blended Teaching, Formative Assessment, Collaborative Learning, <i>CSE</i> Strategies	44
Control	Traditional Teaching Methods	44

The experiment was conducted over two semesters in the 2022–2023 academic year, totaling 32 teaching weeks, and was divided into three stages: pre-test, mid-test, and post-test. The pre-test mainly collected and analyzed the English scores of both groups to establish a baseline validity criterion. Questionnaires were then distributed to assess students' attitudes and learning strategies ^[10]. During the testing period, the control group continued with traditional teaching methods. The experimental group implemented the pre-task planning intervention, including multi-modal process assessment and oral expression strategies based on the CSE.

3. Controlled experiment methods

3.1. “Online-offline” blended teaching approach

Table 2 details the teaching methods used in various instructional phases for the experimental and control groups. The experimental group employed an innovative “online-offline” blended teaching approach, combining digital teaching tools with traditional face-to-face teaching. This aimed to enhance students’ digital literacy while increasing the interactivity and practicality of course content. In contrast, the control group focused on direct instruction and standardized testing, lacking support from modern teaching technologies^[11]. While stable, this traditional approach may be insufficient to fully stimulate student interest and engagement.

Table 2. Comparison of teaching methods

Teaching phase	Experimental group activities	Control group activities
Blended Teaching	Used <i>New Century Business English Listening and Speaking Course I</i> , combined with the Rain Classroom platform for online preview and background knowledge learning. Offline classes explained key points, difficulties, and introduced discussions on social hot topics. Used Rain Classroom for cloze exercises, focused on listening parts including practical expressions, short dialogues, in-depth explanations, and interesting questioning. Analyzed sentences and paragraphs to infer contexts. Watched videos specifically filmed for the textbook covering topics like career planning, enhancing visual experience and understanding of real business scenarios.	Continued using traditional teaching methods without incorporating online resources or modern teaching strategies.
Listening Training		Traditional listening training, potentially lacking interactivity and support from modern teaching tools.
Video Learning		May have used more traditional video materials, lacking the depth and relevance of specially curated content.
Oral Communication Skills Cultivation	Conducted team collaboration and individually assigned activities, such as sentence pronunciation practice, fun dubbing, etc., using WeChat group communication and video assignments to enhance communication skills and creative expression.	Focused on traditional oral expression practice. Apart from oral tests, may not have included innovative interactive activities.

3.2. Diverse formative assessment approaches

In the experimental group, formative assessment was implemented through diverse means such as learning logs, portfolios, and dynamic classroom teaching evaluations. These methods not only helped teachers understand students’ learning status and needs but also promoted communication and collaboration among students, aiding them in deeper reflection and understanding of the learning content^[12]. In contrast, the control group emphasized evaluating students’ academic performance through standardized tests, paying less attention to individualized learning needs and processes. While this method can quickly and conveniently measure academic levels, it overlooks important aspects such as students’ creativity, collaborative ability, and self-motivation. **Table 3** below presented the comparison of formative assessment methods.

Table 3. Comparison of formative assessment methods between experimental and control groups

Assessment Stage	Experimental Group Activities	Control Group Activities
Learning Logs	Students wrote learning logs recording progress, reflecting on shortcomings, and formulating study plans. Teachers understood students' thoughts and needs via logs, adjusting strategies to enhance interaction and oral practice.	Students may have been required to write logs, but focus was more on task completion status, less used for adjusting teaching strategies.
Portfolios	Created portfolios documenting student growth experiences, stage evaluation results, and works for comprehensive assessment of progress and development level.	The control group may have only recorded grades, paying less attention to process documentation and personal growth records.
Classroom Teaching Evaluation	Implemented dynamic classroom evaluation, including oral recording feedback and peer evaluation, promoting mutual learning among students, learning from strengths, and strengthening learning motivation and confidence.	Mainly conducted teacher-led evaluations, such as mid-term/final exams and direct teacher oral feedback, rarely including student interaction or feedback loops.

3.3. Oral expression strategy training

Table 4 shows how the experimental group conducted specialized training targeting the six types of oral expression abilities described in the *CSE* through specific and diverse activity tasks. These activities aimed to improve students' practical language application ability, critical thinking, and response ability in emergencies. In contrast, while the control group's methods could improve language ability to some extent, they may be insufficient for comprehensively enhancing students' abilities in practical application, emergency response, and critical thinking. This comparison helps validate the practical teaching effectiveness of the *CSE*, particularly concerning oral expression.

Table 4. Comparison of teaching methods between experimental and control groups

Oral expression ability	Experimental group activities (Based on CSE)	Control group activities (Traditional teaching)
Oral description	Used scenario simulation and specific sentence pattern practice to deepen ability to describe contexts like office meetings.	May have only used textbooks and standard questions for description practice.
Oral narration	Used keywords and blackboard writing to help students retell content, strengthening comprehension and expression of listening materials.	Primarily relied on teacher explanation and individual student memorization/retelling.
Oral explanation	Used video learning and group shadowing to improve accuracy and clarity of expression in emergencies.	Traditional demonstration and shadowing, lacking emergency response training.
Oral instruction	Used maps and travel brochures for practical instruction practice, enhancing practical application ability.	Taught instructions through standardized materials, lacking practical application.
Oral discourse/presentation	Used debates and case analysis to enhance students' critical thinking and expressive ability.	Traditional classroom lectures and simple example problems, lacking in-depth analysis and discourse.
Oral interaction	Used oral presentations and peer evaluation to enhance interaction and feedback, improving communication efficiency.	Traditional classroom interaction, lacking systematic evaluation and feedback mechanisms.

4. Analysis of controlled experiment results

The research results indicate that implementing pre-task planning can significantly enhance students' self-

efficacy. This effect is manifested indirectly through learning behaviors (such as effort, persistence, and seeking help), cognition (such as strategy use and metacognition), and motivation (such as interest, values, and affect).

4.1. Analysis of questionnaire results

Table 5 shows the reliability test results of the Oral Self-Efficacy Questionnaire administered to 44 university students. The calculated Cronbach's $\alpha = 0.891$ (> 0.8), indicating high internal consistency of the questionnaire, signifying high reliability suitable for assessing students' oral confidence levels.

Table 5. Reliability analysis of oral self-efficacy questionnaire

Sample Size	Number of Items	Cronbach's α Coefficient
44	4	0.891

Table 6 shows the results of the one-sample t-test. The mean scores for all four questionnaire items reached statistical significance, with p-values far below 0.01. This indicates that the subjects generally expressed a certain level of confidence in various oral tasks, particularly in expressing views on professionally related topics (Mean = 3.045). It also suggests potential for further improvement in oral self-efficacy.

Table 6. One-sample t-test analysis results

Item	Sample Size	Min	Max	Mean (M)	Std. Dev. (SD)	<i>t</i>	<i>p</i>
I can describe personal experiences in detail and accurately express personal feelings.	44	1.0	5.0	2.886	0.813	23.546	0.000**
I can express my views on social hot topics in an organized manner after preparation.	44	1.0	5.0	2.955	0.861	22.751	0.000**
I can effectively communicate or negotiate orally on daily life matters such as business, tourism, shopping, etc.	44	1.0	5.0	3.023	0.876	22.896	0.000**
After preparation, I can briefly express opinions on topics related to my major, logically presenting viewpoints and highlighting main ideas during the presentation.	44	1.0	4.0	3.045	0.776	26.025	0.000**

Table 7 displays the English oral test scores of the experimental group over two semesters. The average oral score improved from 84.318 to 85.295, and the standard deviation decreased from 10.483–9.167. This indicates that oral performance became more consistent and showed slight improvement. This enhancement reflects the effectiveness of the teaching methods and the gradual strengthening of students' oral abilities.

Table 7. Basic indicators of English oral tests

Semester	Sample Size	Min Score	Max Score	Mean (M)	Std. Dev. (SD)	Median
First Semester	44	60	96	84.318	10.483	88
Second Semester	44	55	97	85.295	9.167	88

4.2. The impact of pre-task planning intervention

Students did not fully recognize the importance of reflection and summarization for improving their learning ability. A shift from initial active participation to gradual passivity was observed, suggesting traditional methods

may fail to sustain learning motivation and maintain long-term enthusiasm. Under traditional teaching, students might focus more on completing assigned tasks, paying insufficient attention to enhancing practical language skills through diversified learning methods. For example, students with lower self-efficacy tended to avoid complex oral tasks and were unwilling to engage in extra language practice outside class. Improvements in oral expression ability were likely limited. While students with higher self-efficacy might exert extra effort to improve, those with lower self-efficacy appeared more hesitant and less confident in oral expression. Traditional teaching methods generally failed to fully mobilize all students' learning motivation, particularly those with lower self-efficacy. The implementation significantly impacted students' learning methods, oral expression ability, and overall learning outcomes. It increased student participation, enhanced their self-efficacy, and improved language skills and learning experiences.

4.2.1. Impact on students' learning strategies

Within the experimental group, through interaction with peers and teachers, students were able to select and adopt learning strategies more suited to themselves. This strategic choice was reflected not only in the improvement of oral expression ability but also in the enhancement of students' overall attitude and interest towards language learning. **Table 8** shows students' choices of strategies during oral communication tasks, aiding in the analysis of differences and commonalities in students' strategic choices during the oral communication process. Students in the experimental group showed particularly prominent strategy usage, demonstrating high receptiveness to oral expression strategies. For example, 81.82% of students stated they could reasonably adjust speech content through preparation or rehearsal to enhance effectiveness, while 79.55% could use props or media to help listeners better understand. The data also show that students in the experimental group exhibited positive attitudes towards evaluation and remedial strategies, with 65.91% able to avoid misunderstandings by rephrasing to emphasize key points. Compared to the control group, students in the experimental group displayed more proactive and adaptive behavior in adopting and applying learning strategies, reflecting the positive impact of the pre-task planning intervention. This teaching intervention promoted their adoption of more diverse and effective learning strategies during the learning process, leading to better performance.

Table 8. Students' learning strategy choices

Strategy description	Count	Percentage
Can reasonably adjust speech content through preparation or rehearsal to enhance expression effectiveness.	36	81.82%
Can timely summarize discussion content to ensure it stays on topic.	27	61.36%
Can ask questions to confirm if the other party understands the content of their conversation.	28	63.64%
Can use props, digital media, or visual aids to help listeners better understand the speech content.	35	79.55%
Can actively adapt to others' language habits (e.g., using internet slang) to facilitate smooth communication.	22	50.00%
Can use common sentence patterns or fillers (e.g., "I mean...").	28	63.64%
When encountering difficulties in expression, can use methods like paraphrasing, giving examples, or literal translation to convey meaning indirectly.	20	45.45%
Can politely request speaking opportunities during formal discussions.	23	52.27%
Can accurately use non-verbal means (e.g., eye contact, facial expressions, body language) to assist expression based on communication content and needs.	28	63.64%
Can emphasize key points by rephrasing to avoid misunderstandings.	29	65.91%
Can self-correct verb tense errors promptly during oral expression.	19	43.18%

4.2.2. Impact on students' oral ability

According to **Table 9**, 88.64% of students in the experimental group believed that the diverse teaching methods helped improve their oral ability; 75% felt that teamwork promoted their progress; 63.64% reported an increase in their interest in learning English; 56.82% believed their confidence in learning English was enhanced. These differences reflect the effectiveness of diverse teaching methods and active teaching interventions in improving students' English oral ability.

Table 9. Student feedback on the impact of the teaching model

Option	Percentage
This model helps improve oral ability.	88.64%
Enhanced confidence in learning English.	56.82%
Increased interest in learning English.	63.64%
Promoted teamwork with classmates.	75%

Table 10 and **Table 11** compare the score distributions of the control group and the experimental group respectively. The control group's scores (**Table 10**) were mainly concentrated in the higher ranges, with 16 students (36.36%) in the 80–89 range and 24 students (54.55%) scoring 90 or above. The average score was 88.61 with a standard deviation (SD) of 6.88. This indicates the control group's performance was generally good, but scores varied considerably. In contrast, the experimental group (**Table 11**) had a higher proportion of students scoring 90 or above (60.00%). However, their average score was slightly lower (87.4), and the standard deviation was higher (8.48), indicating a more dispersed score distribution. These differences suggest that the experimental group's teaching methods offered some advantage in helping students achieve higher scores, particularly noticeable in the highest score range. However, the higher dispersion in the experimental group's scores suggest the teaching methods may have had a more varied impact on different students. This necessitates further adjustments to teaching methods to ensure more balanced educational outcomes for all students.

Table 10. Score distribution of control group

Score Range	< 60 (Fail)	60–69	70–79	80–89	≥ 90	Cheating	Absent
Count	0	1	3	16	24	0	0
Percentage	0.00%	2.27%	6.82%	36.36%	54.55%	0.00%	0.00%
Mean (M)	88.61						
Std. Dev. (SD)	6.88						

Table 11. Score distribution of experimental group

Score Range	< 60 (Fail)	60–69	70–79	80–89	≥ 90	Cheating	Absent
Count	0	2	8	8	27	0	0
Percentage	0.00%	4.44%	17.78%	17.78%	60.00%	0.00%	0.00%
Mean (M)	87.4						
Std. Dev. (SD)	8.48						

5. Conclusion

This study employed a controlled experiment method to conduct a detailed investigation and analysis of oral self-efficacy and English oral communication ability among university students in border regions. By implementing pre-task planning intervention and CSE-based teaching strategies, the research found that students in the experimental group showed significant improvement compared to the control group in terms of learning strategy choices and oral communication ability. These achievements not only demonstrate the effectiveness of diverse teaching strategies but also highlight the important role of teaching innovation in promoting the development of students' comprehensive language application abilities. However, this study selected students from the same university, which may not represent a broader relevant population. Secondly, the study primarily explored the impact of pre-task planning intervention on oral communication participation, self-efficacy, and motivation; other factors warrant further investigation. Thirdly, the study adopted a dichotomy, categorizing oral tasks as simple or complex, which may not suit all learners. Future research could consider adopting a more refined grading standard. This would help analyze the specific effects of pre-task planning intervention more meticulously, thereby providing more precise reference suggestions for teaching practice.

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Disclosure statement

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Research on the Approaches of Integrating Curriculum Ideology and Politics into Middle School Biology

Dehong Wang*

Xinjiang Karamay Education Research Institute, Karamay 834000, Xinjiang, China

**Author to whom correspondence should be addressed.*

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Abstract: With the development of social economy, the subjects, methods, and contents of ideological and political education have undergone changes. It is not only necessary to give full play to the role of ideological and political courses but also to focus on exploring teaching forms and methods to promote the realization of the goal of “fostering virtue through education”. Under the background of the new curriculum reform, in middle school biology teaching, it is necessary to implement “fostering virtue through education”, carry out ideological and political education, effectively improve the effect of talent training, and promote the development of students’ values. From the perspective of middle school biology, this paper discusses the necessity of integrating curriculum ideology and politics, analyzes the principles that should be followed in the infiltration of ideological and political elements, and puts forward specific strategies for biology teaching practice, aiming to cultivate students’ good values and lay a solid foundation for their subsequent knowledge learning.

Keywords: Curriculum ideology and politics; Middle school; Biology

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1. Introduction

Curriculum ideology and politics is a trend in teaching development, which refers to exploring the ideological and political elements contained in courses and integrating them into teaching practice to promote the unification of teaching and educating people. The middle school biology discipline not only contains a lot of biological knowledge but also involves rich ideological and political elements, which deserve in-depth exploration by teachers. The integration of the concept of curriculum ideology and politics into middle school biology classrooms can expand the course content, create a good classroom environment, and cultivate students’ comprehensive quality.

2. The necessity of integrating curriculum-based ideological and political education into middle school biology teaching

2.1. Meeting the needs of the new curriculum reform

The deepening of the new curriculum reform is conducive to the implementation of quality-oriented education, safeguarding students' all-round development, and is one of the important ways to cultivate talents needed by the times ^[1]. The new curriculum emphasizes the transformation of knowledge impartation, focusing on cultivating students' thinking and inquiry abilities. It encourages students to continuously change their learning methods in the process of studying biology knowledge, combine textbooks with real-life issues, and develop insightful perspectives on social development. The new curriculum standards can reflect the concepts advocated by the reform, attaching importance to cultivating students' awareness of life, scientific thinking, and social responsibility. Middle school biology, which mainly studies life phenomena and laws, contains a wealth of inquiry experiments. Through activities such as analyzing biological phenomena, raising questions, and designing experiments, teachers can effectively cultivate students' awareness of life, foster their spirit of exploration, and encourage them to take on social responsibilities.

2.2. Effectively supplementing the content of ideological and political courses

Ideological and political courses are important channels for spreading ideological and political theories. However, they have problems such as monotonous methods and boring content, making it difficult for students to conduct in-depth exploration. As a result, students' ideological and moral concepts may lag behind, and it is hard to achieve the goal of cultivating virtue through education. The promotion of the curriculum-based ideological and political education concept helps integrate ideological and political elements with subject teaching, enabling students to perceive the charm of ideological and political knowledge while learning subject knowledge, effectively enhancing their enthusiasm for knowledge exploration, and supplementing the content of ideological and political courses ^[2]. In this regard, the cooperation between curriculum-based ideological and political education and ideological and political courses can meet the needs of curriculum reform, effectively expand course content, and satisfy the requirement of cultivating virtue through education.

3. Principles to be followed in infiltrating ideological and political education concepts into middle school biology classes

3.1. Integration of theory and life

In the implementation of ideological and political education in middle school biology, attention should be paid to improving students' ideological understanding and restraining their behavioral habits. The integration of ideological and political education, life, and social practice can optimize the implementation of strategies and integrate theoretical learning with practice. Among them, the use of life-oriented cases containing ideological and political elements in biology can effectively arouse students' resonance and enhance their enthusiasm for knowledge exploration ^[3]. In addition, teachers need to provide more practical opportunities for students according to the characteristics of biology courses to help them achieve the unity of knowledge and practice.

3.2. Innovation

To keep biology teaching activities in line with the times, teachers need to innovate biology courses in combination with the requirements of the new curriculum reform, build a good knowledge learning environment for students, attach importance to the formation of their learning habits, cultivate students' abilities to collect information,

discover and solve problems, and organically integrate ideological and political elements into them ^[4].

In the process of classroom teaching, teachers can choose different teaching methods according to the differences in ideological and political elements to ensure the realization of teaching goals, effectively stimulate students' enthusiasm for knowledge learning, and allow them more time for thinking and communication. A relaxed biology classroom environment can help students explore knowledge and thus cultivate their core literacy.

3.3. Equality between teachers and students

In middle school biology teaching, students play the role of reflectors, which can intuitively show the teaching effect. Various teaching activities cannot be carried out without the joint participation of teachers and students. In this regard, to improve the effect of ideological and political education in biology courses, teachers need to play a good guiding role, attach importance to the dominant position of students, and establish a good teacher-student relationship. The concept of equality provides a prerequisite for the construction of teacher-student relationships ^[5].

To encourage students to actively participate in the learning of ideological and political knowledge, schools need to attach importance to the construction of an equal teacher-student relationship, guide students to selectively absorb knowledge, effectively improve teaching effectiveness, and ensure the smooth implementation of teaching strategies.

4. Practical strategies for integrating the ideological and political education concept into middle school biology classrooms

4.1. Refine teaching objectives and infiltrate subject literacy

In the process of implementing the concept of ideological and political education in courses, teachers need to attach importance to the adjustment of teaching objectives. They should carry out practical teaching activities by establishing connections with professional training goals and integrating them with the course content ^[6]. Against the backdrop of the new curriculum reform, cultivating students' core competencies have become an important criterion for evaluating their learning and growth in middle school biology classrooms. To effectively enhance students' core competencies, teachers can start from the perspective of the traditional three-dimensional objectives, optimize and adjust them, emphasize the cultivation of core competencies, and design reasonable teaching objectives.

Guided by core competencies, teachers can create real teaching scenarios, understand students' needs, and design activities to address teaching issues while meeting the requirements of teaching tasks and multiple needs such as knowledge construction and ability cultivation. However, due to the comprehensive and implicit nature of biology classrooms, they can effectively implement core competencies and optimize teaching activities. Among them, teachers can promote the transformation of biological literacy by connecting core competencies with the biology subject and adjust teaching objectives accordingly. In line with the needs of teaching objectives, they can subtly integrate ideological and political education goals, not only focusing on the achievement of knowledge objectives but also paying attention to the improvement of students' comprehensive quality ^[7].

In summary, to effectively implement the concept of ideological and political education in middle school biology classrooms, teachers must clarify the course teaching objectives, deeply explore the ideological and political elements contained in the curriculum, flexibly design teaching objectives, and promote the integration

of knowledge transmission, ability cultivation, and value shaping. In the actual design of ideological and political objectives for biology classrooms, teachers can refer to students' knowledge cognition, divide objectives hierarchically as a basis, and further adjust them to enhance the operability of teaching objectives.

4.2. Optimize classroom atmosphere and improve education effectiveness

In middle school teaching, the classroom is the main front for implementing the concept of ideological and political education, playing a crucial role in biology classrooms. To better implement this concept, teachers can take various measures in biology teaching to enable students to gain positive emotional and behavioral experiences. A relaxed and pleasant classroom environment can ensure the smooth progress of teaching practice, stimulate students' interest in learning, and cultivate their enthusiasm for biology. In middle school biology teaching, to effectively improve the classroom atmosphere, teachers need to communicate closely with students and build a good teacher-student relationship.

Based on a democratic teacher-student relationship, students play the main role in the classroom, while teachers mainly act as guides, allowing students to gain more autonomy in the classroom. Teachers can guide students to participate in classroom learning, actively express their thoughts and viewpoints, and such teacher-student interactions help create a positive biology classroom environment ^[8]. In addition, in biology classroom practice, teachers should pay attention to their language art. Vivid language can effectively ease students' tension and help them concentrate.

In the evaluation process of biology classes, teachers need to focus on encouragement and guidance, enhance students' confidence in the classroom, and help them develop the habit of expressing themselves bravely. Through these activities, a good biology classroom atmosphere can be created, the concept of ideological and political education can be smoothly implemented, and students' innovative ability and critical thinking can be effectively cultivated.

4.3. Expanding ideological and political resources to enhance teaching effectiveness

Middle school biology courses, based on the cognition of nature, help demonstrate life phenomena, operational mechanisms, and other contents. They contain rich ideological and political education elements and possess significant educational value (as shown in **Table 1**).

Table 1. Ideological and political elements in middle school biology courses

Ideological and Political Dimension	Ideological and Political Connotation
Family and National Feelings	Patriotism, family feelings, national pride and self-respect, sense of gratitude, etc.
Political Identity	Upholding the leadership of the Party, loving socialism, identifying with the socialist system, etc.
Scientific Spirit	Seeking truth from facts, value orientation of exploration and innovation, etc.
Awareness of the Rule of Law	Learning about law, abiding by law, using law, identifying with the construction of the legal system, actively participating in legal construction, and handling affairs according to law
Ecological Awareness	Ecological concepts, respecting people, respecting nature, and focusing on the harmonious development of society.

In teaching practice, teachers should not only explore the ideological and political elements embedded in the curriculum but also attach importance to constructing a system of ideological and political resources

for biology courses. By integrating texts, images, and other materials and conducting classification work, teachers can truly achieve coherence and unity in the teaching planning and vertical progression of ideological and political resources, as well as horizontal complementarity, thereby achieving a harmonious and consistent effect and improving the quality of ideological and political education ^[9]. The construction of an ideological and political resource library for courses is systematic and requires the joint participation of teachers. For the biology discipline, common textual resources include not only textbooks but also extracurricular readings. Teachers can also collect and organize daily news related to biology.

Regarding biological activity resources, teachers can integrate biology competitions and engage with interest groups to facilitate the continuous accumulation of knowledge. In addition, biological material resources offer multiple choices, including biological models, images, and daily life entities. Against the backdrop of the information age, teachers can enhance the use of information resources by sorting and summarizing images and videos. They should also make full use of local ideological and political resources based on local conditions, such as red culture and local folk culture, to effectively expand resources for ideological and political education and provide more space for teachers to participate in ideological and political teaching. Enriching biological ideological and political resources can effectively stimulate students' enthusiasm for knowledge exploration, encourage them to reflect on patriotism, family feelings, and the concept of the rule of law, and ensure the effectiveness of ideological and political education in biology courses.

4.4. Skillfully using role-playing to improve learning efficiency

In the process of teaching practice, teachers can innovate biology classes, follow the requirements of the concept of ideological and political education in courses, and combine students' life experience to help them understand biological knowledge and improve teaching quality. The implementation of ideological and political education in middle school biology courses not only relies on teachers' lectures but also requires the joint participation of students to achieve good teaching results. In the teaching of biological knowledge, teachers can also use role-playing to create a good classroom environment ^[10]. For example, when teaching content related to biological ecosystems, teachers can adopt group cooperation and encourage students to play roles such as producers, consumers, and decomposers. In this process, teachers can play an organizing role and create scenarios, allowing students to experience the serious consequences caused by problems at the trophic level as participants themselves. By guiding students to have personal experiences, the importance of environmental protection can be highlighted, enabling students to develop a good concept of life and continuously respect and protect nature.

4.5. Changing teachers' concepts and enhancing moral cultivation

In middle school biology classes, teachers are professional personnel, and their professional nature usually determines the roles they play. In the process of biology teaching, it is not only necessary to focus on knowledge teaching but also to emphasize shaping students' character, enabling them to gradually grow into members who meet social needs. For this reason, teachers often play an exemplary role, and in the quality of the teaching staff, teachers' ethics and morals are the primary criteria for evaluation. This shows that in daily teaching, teachers need to continuously standardize their words and deeds in communication activities with students, exert a good exemplary role through their words and actions, and truly live up to the saying that "a teacher must be knowledgeable and virtuous". In terms of moral cultivation, teachers also need to play an exemplary role, positively influence students through their own actions, and improve the effect of education.

In addition, in the practice of middle school biology teaching, to effectively carry out ideological and

political education in courses, teachers need to have credibility, which mainly comes from teachers' behaviors, communication, etc. Among them, teachers need to master biological knowledge proficiently, keep pace with the times, deeply understand historical development, learn the latest teaching methods, and focus on current political information. Through the implementation of the above activities, teachers can effectively connect biology with ideological and political knowledge, providing a guarantee for the smooth development of ideological and political education in courses.

To enable teachers to grow into comprehensive learning-oriented teachers, it is possible to continuously improve their moral literacy by changing their concepts, setting a good example for students. The exemplary role of teachers can not only be reflected in knowledge teaching but also in shaping students' values. The words and deeds of teachers are all objects of students' imitation. Therefore, teachers need to strictly demand themselves, pay attention to the improvement of moral cultivation, continuously adjust biology classroom teaching, positively influence students, and achieve good teaching results.

5. Conclusion

To sum up, the integration of ideological and political education concepts into middle school biology teaching meets the needs of educational development, helps achieve the fundamental task of fostering virtue through education, and enables students to master biological knowledge while developing good ideological and moral qualities, moving towards all-round development. Specifically, teachers can effectively infiltrate ideological and political elements into middle school biology classrooms by refining teaching objectives, optimizing classroom atmosphere, and organizing role-playing activities. This practice implements the concept of ideological and political education in courses, enriches the content of biology classes, promotes the realization of educational goals, and builds high-quality biology classrooms.

Disclosure statement

The author declares no conflict of interest.

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Challenges and Innovations in Ideological and Political Education for College Students in the Micro-Public Opinion Environment

Haoyue Zhang*, Shumin Yan

Binzhou Medical University, Yantai 264003, China

**Author to whom correspondence should be addressed.*

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Abstract: The micro-public opinion environment, characterized by information fragmentation, instantaneous dissemination, emotional contagion, and diverse values, has profoundly transformed the information acquisition patterns and cognitive formation processes of college students. It also poses new challenges and opportunities for innovation in ideological and political education (hereinafter referred to as “IPE”) for college students. Starting from the contemporary value of IPE for college students, this paper analyzes the logical connection between the micro-public opinion environment and IPE, thoroughly examines the core challenges faced by IPE in this context, and proposes specific innovative paths from four perspectives: content, methods, subjects, and mechanisms. The aim is to provide insights for enhancing the pertinence and effectiveness of IPE for college students in the micro-public opinion environment.

Keywords: Micro-public opinion environment; College students; Ideological and political education; Educational innovation

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1. The logical connection between the micro-public opinion environment and ideological and political education for college students

The micro-public opinion environment is not an “external field” independent of the realm of IPE but rather exhibits a deep logical coupling with IPE.

The micro-public opinion environment represents a “new frontier” for ideological and political education. Traditional ideological and political education primarily relies on established settings such as classroom instruction and offline activities. However, the micro-public opinion environment breaks free from the constraints of time and space, extending the scenarios of ideological and political education into college students’ daily social interactions and information browsing^[1]. Every instance of information reception and opinion expression by college students on micro-platforms is, in essence, a process of ideological interaction.

This makes the micro-public opinion environment a “vanguard position” that ideological and political education must seize. If ideological and political education fails to actively engage in this space, erroneous ideologies and negative public opinions will fill the ideological void.

The propagation characteristics of micro-public opinion and the cognitive traits of college students exhibit a phenomenon of “interactive resonance”. College students have a high receptivity to novel things and are enthusiastic about participating in interactions. Meanwhile, micro-public opinion disseminates through concise forms such as short videos, graphics, and topic discussions, aligning with college students’ information consumption habits. Conversely, the expressions of opinions by college students become a significant source for the generation and dissemination of micro-public opinion, influencing its dynamic trajectory^[2]. This “interactive resonance” underscores the necessity for ideological and political education to align with the propagation rhythm of micro-public opinion and the cognitive patterns of college students; otherwise, achieving the anticipated outcomes of ideological guidance will be challenging.

Ideological and political education serves as the “core anchor for mainstream values” in the micro-public opinion environment. The diverse manifestations of values within the micro-public opinion environment can easily lead to “value disorder”. One of the core functions of ideological and political education is to provide college students with a stable yardstick for value judgment by disseminating mainstream values. Simultaneously, it integrates mainstream values into the dissemination of micro-public opinion, mitigating the impact of erroneous ideologies, guiding micro-public opinion towards a positive and healthy direction, and fostering a constructive micro-public opinion landscape^[3].

2. Core challenges facing ideological and political education for college students in the micro-public opinion environment

2.1. Fragmented micro-public opinion information undermines the systematic nature of ideological and political education

One of the core objectives of ideological and political education is to facilitate the formation of a comprehensive and systematic ideological cognition and value system among university students. This requires a content system that is logically coherent and well-structured. However, most information in the micro-public opinion environment exists in a “fragmented” form: a short video clip, a brief comment, or a graphic typically presents only a single viewpoint or partial fact, lacking comprehensive background explanations and logical deductions. Such fragmented information can hinder university students’ systematic grasp of ideological and political content. For instance, in education on “patriotism”, traditional ideological and political classrooms would unfold according to the logic of history, theory, and practice.

In contrast, micro-public opinion tends to revolve around specific events in fragmented discussions, making it difficult for university students to grasp the profound connotations of patriotism from an overall perspective. This may even lead to one-sided understandings, thereby diminishing the systematic effectiveness of ideological and political education^[4].

2.2. Widespread dissemination of emotions in micro-public opinion weakens the rational guidance of ideological and political education

The micro-public opinion environment is characterized by “emotion-driven dissemination”: compared to rational viewpoints, content filled with strong emotions is more likely to attract attention and be shared, leading to the rapid spread of emotions in micro-public opinion. University students, with their relatively sensitive

emotional experiences, are susceptible to the influence of negative emotions in micro-public opinion, thereby forming a cognitive pattern where “emotions precede reason”.

The key to ideological and political education lies in employing rational analysis and logical reasoning to guide university students toward forming correct cognitions. When emotional generalization dominates in micro-public opinion, university students often overlook rational scrutiny of information and are more inclined to make judgments based on emotions. This results in the dilution of the rational guidance role of ideological and political education, even leading to a situation where “emotions overwhelm rational viewpoints”.

2.3. The values presented in micro-public opinion are diversified, posing a challenge to the development of mainstream value identification

The key task of ideological and political education is to promote the establishment of college students' identification with mainstream values. However, the openness of the micro-public opinion environment facilitates the rapid dissemination of various values. Some micro-public opinions package erroneous viewpoints in “seemingly legitimate” forms, advocating individualism under the pretext of “pursuing personal freedom” and spreading historical nihilism under the guise of “reflecting on history”. These viewpoints easily align with college students' psychological aspirations for “independent thinking,” thereby exerting a certain impact on their identification with mainstream values. The dissemination logic of “traffic first” in micro-public opinion enables some negative and vulgar values to spread widely due to their ability to “attract public attention”, further weakening college students' sense of identification with mainstream values and increasing the difficulty of ideological and political education in leading values ^[5].

2.4. The adaptability of educational subjects is inadequate, lagging behind the pace of micro-public opinion dissemination

As implementers of ideological and political education, the ability of educational subjects to adapt to the micro-public opinion environment directly affects educational outcomes. Some educational subjects exhibit obvious “inadequate adaptability” issues: a lack of understanding of the dissemination patterns of micro-public opinion, unfamiliarity with the operational logic of micro-platforms, and difficulty in actively engaging in educational activities within the micro-public opinion sphere. Their response speed to micro-public opinion is slow, micro-public opinion dissemination is instantaneous, and a topic involving college students can quickly gain traction within a few hours. However, some educational subjects still adopt the approach of “offline research, collective discussion, and delayed response”. When the response speed of ideological and political education fails to keep pace with the dissemination rhythm of micro-public opinion, college students are already influenced by other viewpoints in the micro-public opinion, causing the guidance of ideological and political education to miss the “most opportune moment” and making it difficult to achieve practical effects ^[6].

3. Innovative approaches to ideological and political education for college students in the micro-public opinion environment

3.1. Content innovation: Establishing a “fragmented + in-depth” ideological and political content system

3.1.1. Breaking down core ideological and political content into micro-modules

Divide the systematic content of traditional ideological and political education into “micro-knowledge points”, with each micro-module focusing on a specific theme and keeping the length within a reasonable range of

“5-minute reading” or “3-minute viewing”. The content of micro-modules should be “clear in viewpoint and concise in logic”, while adopting lightweight presentation forms that align with the dissemination characteristics of micro-platforms. This allows college students to receive ideological and political content during their fragmented time, gradually accumulating and forming a systematic understanding.

3.1.2. Embedding ideological and political connotations into micro-public opinion hotspots

Establish a linkage mechanism between micro-public opinion hotspots and ideological and political content. When hot topics related to college students emerge in micro-public opinion, immediately extract the ideological and political elements within the topics and integrate them into the hot discussions. For example, when micro-public opinion discusses “difficulties in college student employment”, micro-content can be produced from ideological and political perspectives such as “the alignment of personal ideals with social needs”, “the inheritance of the spirit of hard work”, and “the supporting logic of national employment policies”. This not only responds to the focal points of college students’ concerns but also conveys the essence of ideological and political education through hot topics, preventing ideological and political content from being “disconnected” from micro-public opinion hotspots and enhancing content relevance and appeal.

3.2. Method innovation: Creating micro-ideological and political scenarios with “immersive + interactive”

3.2.1. Attributes effectively utilizing micro-platforms to build immersive scenarios

Set up immersive ideological and political scenarios tailored to the characteristics of different micro-platforms. First, on short video platforms like Douyin and Kuaishou, create “scenario-based short videos”. By incorporating ideological and political content into the daily learning and living backgrounds of college students, an immersive viewing experience can be generated. Second, on platforms like WeChat Official Accounts and Xiaohongshu, publish “immersive graphics and texts”. From the perspective of college students, record snippets of ideological and political practice, accompanied by on-site photographs and genuine reflections, to create a sense of being present. Third, construct a “virtual ideological and political space” within campus apps, enabling college students to achieve immersive learning experiences through interactive operations ^[7].

3.2.2. Drive the participation of “student-centered” learning to enhance interactive vitality

Transform the conventional “teacher-led” model and encourage college students to transition from “passive recipients” to “active participants”. Firstly, promote the creation of micro-ideological and political education content by college students. Organize a “Micro-Ideological and Political Education Creation Contest”, guiding students to produce short videos, write brief commentaries, and design graphics and text on ideological and political themes. Outstanding works will be promoted on micro-platforms, enabling students to deepen their understanding of ideological and political content through creation. Secondly, facilitate interactive topic debates. Initiate topics related to ideology and politics on micro-platforms, with teachers participating as “equal participants” to guide students in expressing their views and engaging in intellectual collisions, avoiding “isolated preaching”. Thirdly, establish a team of “student ideological and political bloggers”. Select college students with good ideological qualities and strong expressive abilities to serve as micro-ideological and political bloggers. These bloggers will regularly share their insights on ideology and politics and analyze hot topics on micro-platforms, providing ideological guidance from a peer perspective and enhancing interactive effectiveness ^[8].

3.3. Subject innovation: Establish an educational community of “teacher-student collaboration + multi-party cooperation”

3.3.1. Enhance the micro-public opinion literacy of educators

Increase training efforts for ideological and political teachers and counselors on micro-public opinion, covering three main aspects. Firstly, provide training on the dissemination patterns of micro-public opinion, enabling educators to grasp the algorithmic logic, information dissemination pathways, and user behavior manifestations on micro-platforms, as well as the core nodes in the generation and development of micro-public opinion. Secondly, implement practical training on new media skills, including short video production and editing, graphic and text design, and micro-platform operation, empowering educators to independently create micro-ideological and political content and manage micro-ideological and political accounts. Thirdly, conduct training on public opinion response capabilities, teaching methods for identifying negative topics in micro-public opinion, rational response techniques, and emotional counseling strategies, enhancing educators' comprehensive abilities to cope with micro-public opinion risks.

Collaborate with universities, families, and social forces to establish a multi-party cooperation mechanism featuring “universities taking the lead, families providing support, and society offering assistance”. Firstly, establish a cross-departmental collaboration team, where the Ideological and Political Education Department, Student Affairs Department, Publicity Department, and Network Center jointly form a “Micro Ideological and Political Education Work Group”, with clear divisions of labor to pool collective efforts: the Ideological and Political Education Department is responsible for content design, the Student Affairs Department handles student organization and interaction, the Publicity Department promotes micro-platforms, and the Network Center provides technical support and monitors public opinion. Secondly, through forms such as “Parent Micro-Classroom” and “Family Ideological and Political Education Topic Guide”, convey ideological and political education concepts to parents, guiding them to cooperate with universities in conducting ideological and political education during family interactions, thereby fostering an educational environment of “home-school mutual support”. Thirdly, leverage social resources such as mainstream media, high-quality enterprises, and revolutionary education bases, inviting mainstream media journalists, industry leaders, and experts in party history to participate in the creation of micro ideological and political education content, introducing mainstream value resources from the social sphere to diversify the content and forms of micro ideological and political education^[9].

3.4. Mechanism innovation: Improve the public opinion handling system featuring “dynamic monitoring + precise response”

3.4.1. Establish a real-time micro-public opinion monitoring system

Firstly, universities should set up a dedicated micro-public opinion monitoring platform, clearly defining the monitoring scope and focus. The monitoring scope includes micro-platforms commonly used by university students, with a focus on ideological and political hot topics relevant to university students, potential negative public opinion phenomena, and highly discussed student-initiated topics. Secondly, construct a keyword monitoring database, utilizing technological means to conduct real-time capture, classification, summarization, and heat analysis of relevant information. Thirdly, recruit dedicated monitoring personnel to manually verify the monitored information, ensuring its accuracy and timeliness, and providing evidence for subsequent response efforts.

3.4.2. Develop a rapid response plan for ideological and political education

Based on monitoring results, establish a tiered response mechanism that clarifies the processing procedures

and responsible entities for different types of public opinion. Firstly, for general positive public opinion, the response should focus on “strengthening guidance”. Utilize micro-platforms to forward and comment, expanding the influence of positive public opinion and integrating ideological and political connotations. For neutral discussion-based public opinion, the response should center on “rational guidance”. Ideological and political education teachers should publish rational analysis articles and initiate discussion topics on micro-platforms, guiding university students to enhance their understanding of issues from an ideological and political perspective. For potentially negative public opinion, the response should prioritize “timely clarification”. The micro-ideological and political education working group should swiftly release clarifying information and interpret mainstream ideologies to prevent further dissemination of the public opinion. For highly publicized negative public opinion, the response should emphasize “collaborative handling”. Activate cross-departmental cooperation mechanisms, working together with the Publicity Department, Student Affairs Department, and counselors to provide multi-dimensional guidance. Simultaneously, mainstream media should be enlisted to publish positive content to counteract the impact of negative public opinion ^[10].

4. Conclusion

The advent of the micro-public opinion environment has not only posed challenges to ideological and political education for university students but also provided an opportunity for innovation in this field. Faced with the characteristics of fragmented information, widespread emotional dissemination, diverse values, and rapid transmission in the micro-public opinion environment, ideological and political education for university students cannot afford to be “passively reactive”. Instead, it needs to proactively “adapt and innovate” to uphold the crucial task of “fostering virtue and cultivating talent” in the micro-public opinion environment. This approach will assist university students in adhering to mainstream values amidst diverse information, maintaining rational thinking amidst emotional turmoil, and growing into socialist builders and successors who meet the needs of the new era.

Disclosure statement

The author declares no conflict of interest.

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Research on the Development of the Grade Point Average System in Higher Education—Re-understand the Connotation and Function of GPA

Wenxiu Zhang*

Beijing International Studies University, Beijing 100024, China

**Author to whom correspondence should be addressed.*

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Abstract: With the continuous advancement of the internationalization of higher education in China, the Grade Point Average (GPA) has become a primary indicator for evaluating academic performance in universities, playing a positive role in educational management. However, as it is closely tied to students' immediate interests, such as awards, exemptions from entrance exams for postgraduate recommendations, and domestic or international further education, certain new issues have emerged in its practical application. These problems have hindered the effective functioning of the GPA system, attracting widespread attention. This paper examines the origin, connotation, and theoretical assumptions of the GPA system, discusses its positive functions and existing challenges, and proposes recommendations for further improving academic evaluation.

Keywords: Point system; Grade point average (GPA); Academic evaluation; Educational management

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1. Introduction

The grade point system is a crucial teaching management mechanism in modern higher education, employing the Grade point average (GPA) to assess both the quality and quantity of student learning, the grade point system discussed in this paper refers to GPA in its broad sense. In recent years, with the ongoing reforms in higher education, GPA has been adopted by an increasing number of universities and has gradually become a core metric for evaluating students' academic performance and comprehensive competencies. However, certain issues have surfaced during its implementation, prompting scholars to reflect on the efficacy and limitations of GPA. Against this backdrop, a thorough exploration of the educational management logic of GPA, tracing its origins, connotation, and original design intent, is essential for clarifying its role as an educational management mechanism. Such an analysis holds significant importance for optimizing university teaching management and enhancing educational quality, thereby providing theoretical support for deepening the reform of higher education evaluation in China.

Given that the implementation of this system varies globally, particularly in terms of its effectiveness and associated challenges, this paper will focus on the context of China, even though similar issues and conditions may also be relevant in other educational systems.

2. The origin and development of GPA

2.1. The origin of GPA

The Grade Point Average (GPA) is a widely adopted academic evaluation system in higher education, functioning as a teaching management mechanism that converts raw course scores into grade points based on predefined rules^[1]. It originated in the United States. The emergence of GPA is closely tied to the development of the elective course system and the credit system. In the late 18th century, German educator Wilhelm von Humboldt actively advocated for academic freedom and individualized education, emphasizing that higher education should cultivate learners' independent character and creative abilities^[2]. Guided by this philosophy, he pioneered the elective course system at the University of Berlin, using it as a key vehicle to implement his educational ideals.

In 1825, the elective course system was experimentally introduced in the United States. By 1869, under the leadership of President Charles W. Eliot, Harvard University implemented a significant educational reform. Addressing the shortcomings of traditional education models that neglected individual differences, Eliot proposed a personalized cultivation approach, arguing that students vary significantly in aptitude, interests, and other aspects, and that a uniform teaching model would constrain their potential. To address this, he advocated for expanding students' course selection options, granting them autonomy to choose learning content based on their interests and abilities. However, due to the lack of a unified metric for comparing course progress and the varying quality of courses across departments, Harvard introduced an innovative evaluation mechanism by assigning credits to elective courses based on key parameters such as course difficulty and study hours. This innovation led to the establishment of the credit system.

Subsequently, credits were used to measure students' effective learning time, for example, the "quantity" of learning^[3]. The credit system provided students with a mechanism for autonomous course selection, requiring them to meet course standards to earn corresponding credits. This system ensured the validity of learning outcomes and became a crucial safeguard for achieving educational goals and competency development. However, a limitation of the credit system was its inability to reflect the "quality" of learning, only quantifying its "quantity".

In the early 20th century, with the expansion of the elective course system and the development of the educational testing movement in the U.S., universities needed a standardized method to evaluate interdisciplinary learning quality. To address the limitations of credits in assessing learning quality, some American institutions began introducing the concept of grade points to enhance the credit system. For instance, they adopted a four-point scale (4.0) to calculate academic performance, implemented a "letter grade system", A, B, C, D and F. Then, it was assigned quantitative values to each grade, for example, A = 4.0, forming the rudimentary structure of GPA. Thus, as a "supplementary" measure to "refine" the credit system, GPA emerged. Due to its relatively uniform and quantifiable nature, it was used to assess students' academic performance.

By the 1950s, the American Council on Education (ACE) promoted the standardization of GPA, establishing it as a core criterion for university admissions and scholarship evaluations. Over time, its influence expanded globally.

2.2. The development of GPA in China

In China, the GPA system was initially introduced by Boling Zhang at Nankai University in 1919, but its implementation was subsequently discontinued until its reintroduction into the higher education teaching and student academic evaluation system in 1985^[4]. Against the backdrop of China's ongoing higher education internationalization, the continuous expansion of international student enrollment has necessitated the gradual alignment of domestic universities' academic evaluation systems with international standards. To accommodate this developmental trend, numerous higher education institutions have adopted the GPA system. Currently, this internationally recognized academic assessment method has been comprehensively implemented within Chinese universities' teaching management systems, evolving from initial pilot explorations to a widely adopted core management mechanism that now constitutes an essential component of modern higher education administration systems.

3. The connotation and core logic of GPA

GPA serves as a quantitative tool for academic assessment and a teaching management system complementary to the credit system. Its essence lies in transforming course grades into grade points through relatively standardized and uniform methods to evaluate student performance across different courses, thereby providing an objective measurement and assessment of learning outcomes. Fundamentally, it aims to communicate student learning information through objective evaluation and offer feedback, enabling students to understand their academic status and optimize learning strategies^[5]. Historical analysis reveals that GPA's emergence was predicated on grades being universally recognized as meaningful alphanumeric symbols carrying representational and symbolic significance in educational practice, with stakeholders acknowledging their validity^[6].

3.1. Educational measurement hypothesis

GPA quantifies learning outcomes. Based on the premise of a unilinear “grade-ability” relationship, it posits that course grades objectively and accurately reflect students' knowledge mastery and competency levels. Grade variations across all courses can be standardized through a uniform grade-point conversion scale for example, A = 4.0, B = 3.0, enabling cross-disciplinary, inter-instructor and trans-semester comparability.

3.2. Motivation hypothesis

GPA stimulates academic competition. The educational community generally believes that grades effectively motivate students. As an assessment tool, GPA functions as an incentive mechanism, encouraging greater academic effort. The grade-point differential creates a “reward-excellence, penalize-underperformance” effect, driving students to refine learning strategies.

3.3. Objectivity and fairness hypothesis

GPA standardizes evaluation criteria. Comparatively, GPA represents a fair and objective assessment metric. For students, the equivalency of grade-point values fosters a sense of fair competition and authentically reflects the value of their learning achievements. For institutional administration, GPA shifts the evaluation of learning quality from quantitative scores to qualitative assessment, providing clear benchmarks for academic competitions and educational planning. For employers, GPA offers an objective measure of academic proficiency, facilitating superior candidate selection.

3.4. Goal-attainment feedback hypothesis

GPA optimizes teaching management. It reflects the degree to which students achieve predetermined learning objectives. Instructors can diagnose teaching effectiveness through class GPA distributions such as identifying anomalous grading patterns where consistently high or low scores may indicate needed pedagogical adjustments or even curricular reforms.

4. The role of GPA in higher education management

4.1. Educational evaluation function: Enhancing assessment transparency and fairness

GPA's core advantage lies in its objectivity and standardization. By converting course grades into uniform grade points, it enables normalized evaluation of academic performance, providing comparable feedback for both teaching and learning. Students can conduct horizontal or longitudinal self-assessments through GPA to clarify their academic standing such as "developmental balance", while instructors gain insights into teaching effectiveness and learner characteristics, informing pedagogical adjustments and more targeted instructional interactions.

4.2. Resource allocation efficiency: Facilitating inter-institutional and global compatibility

GPA's international comparability makes it a "universal currency" for student mobility and credit recognition. As a tool for measuring and evaluating course performance, it promotes mutual adaptation of assessment and certification across institutions. Widely adopted globally, particularly in U.S. higher education, European universities frequently employ the "European Credit Transfer and Accumulation System" (ECTS) to convert national grading systems into GPA equivalents. This transparency and interoperability transform GPA into a "technical bridge" for educational recognition, enabling comprehensive cross-system comparisons of academic achievement.

4.3. Institutional incentive effect: Encouraging sustained learning and refined effort

GPA translates learning outcomes into visible, comparable "steps". Clear numerical targets prove more directive than abstract learning requirements, not only stimulating student motivation but also fostering greater course engagement. Through goal visibility and outcome controllability, it effectively activates learning drive.

4.4. Diagnostic and early-warning functions

Corresponding directly to academic performance, GPA serves to evaluate learning progress and effectiveness over time. Its numerical values enable timely identification of at-risk students, providing early warnings and alerts, thereby fulfilling diagnostic and monitoring functions.

5. Problems in the implementation of GPA

Any teaching management system has its applicable scope and contextual limitations. As an educational assessment tool, if its role is excessively amplified, GPA may deviate from its original design intent. Currently, in China, while the development and application of GPA have yielded positive outcomes, they have also triggered several issues that undermine the system's functionality, drawing criticism from scholars.

5.1. Functional alienation of assessment: Inducing learning alienation and utilitarian behavior

Historically, GPA emerged alongside the credit system as a tool to evaluate students' learning capabilities and knowledge levels. However, in China's higher education context, the boundaries of GPA's functions have expanded beyond its original purpose. Many universities now extend its use from academic evaluation to broader educational management, making it a core reference metric for student affairs.

Specifically, GPA data are widely applied in non-academic scenarios such as postgraduate recommendation eligibility, scholarship allocation, and employment referrals. This cross-domain application has led to GPA being misconstrued as an absolute measure of students' comprehensive abilities. When academic evaluation becomes overly tied to extrinsic incentives, students may prioritize achieving high scores over maximizing genuine learning outcomes^[7], shifting their focus from knowledge acquisition to GPA optimization. This instrumental rationality displaces the value rationality of education, creating two forms of alienation. First is the distorted assessment validity, where some students strategically select low-workload courses to inflate their GPAs, where high scores reflect course selection tactics rather than true academic effort or capability. Next is the deformed learning ecology, as the academic competition degenerates into irrational, metric-driven rivalry. Thus, in order to compete and score for high GPAs, students exploit elective freedom to calculate grade trade-offs instrumentally, reducing learning to a byproduct of GPA accumulation^[8].

This creates a paradox where GPA transforms from an assessment tool into an end goal, dictating learning behaviors and causing educational alienation^[9]. Such mechanisms fail to accurately measure real academic achievement and distort the teaching-learning dynamic, ultimately derailing the educational process.

5.2. Weakened diagnostic and early-warning functions

As a core system for measuring learning outcomes, GPA should ideally monitor academic quality and diagnose learning progress, serving as a reference for self-management and skill development. However, in practice, its diagnostic and feedback functions have significantly weakened, while its selective role has intensified, turning it into a competitive mechanism for identifying "high achievers". Research indicates that compared to its focus on top performers, GPA systems often neglect academically struggling students, even undermining their potential for improvement^[10]. This imbalance disproportionately prioritizes a minority of high-ranked students while failing to provide adequate support or early warnings for those in the middle or lower tiers^[14].

5.3. Narrowed evaluation dimensions

GPA's overemphasis on ranking and selection in practice renders it inadequate for assessing critical competencies such as critical thinking, innovation, communication, collaboration, practical skills, social responsibility, emotional attitudes, and aesthetic literacy, all essential for students' future development. This transforms GPA into an "evaluation hegemony", trapping students in a cycle of "learning for GPA" at the expense of holistic growth. Educational goals become hijacked by instrumental rationality, compromising talent cultivation quality. Moreover, as students compete for marginal GPA advantages to employment opportunities, score differentiation diminishes to decimal places, forcing rankings to rely on excessively precise calculations. Such practices strip GPA of its authentic educational purpose, compelling students to obsess over microscopic ranking distinctions while neglecting meaningful learning experiences^[11].

6. Reflections and recommendations

The GPA system, originating during the Industrial Revolution, bears distinct characteristics of industrial-era management. Historically conceived as an assessment tool to measure academic quality, its theoretical foundations reflect this original intent. However, in the current era where artificial intelligence and other technologies are transforming education, industrial-age evaluation standards have become increasingly inadequate for meeting talent cultivation needs in the intelligent era, necessitating a paradigm shift in educational management philosophy and methods^[12]. Re-examine GPA's core values is a must to reconsider its functions, innovate evaluation concepts, and develop new assessment paradigms to promote its healthy development.

6.1. From “screening logic” to “growth logic”: Establishing a diversified developmental evaluation system

Currently, GPA systems adhere to “screening logic” in many universities, employing standardized testing and uniform metrics to stratify students. This approach overlooks learner diversity and developmental potential. We recommend supplementing GPA with additional evaluation dimensions that integrate quantitative and qualitative measures, focusing not just on scores but also on individual student characteristics to create an assessment ecosystem supporting differentiated development. Institutions should gradually optimize GPA-centered evaluation mechanisms by appropriately reducing its weighting in various assessments, positioning GPA as a limited and reasonable screening tool.

Simultaneously, they should maintain a fundamental orientation toward diversified development, incorporating multidimensional indicators including academic achievement, moral character, practical skills, and physical-mental literacy to establish a comprehensive, balanced evaluation system that effectively guides students coordinated development in moral, intellectual, physical, aesthetic, and labor education^[13].

6.2. From “summative judgment” to “processual navigation”, constructing a dynamic assessment system

Universities should establish stable systems and platforms enabling students to promptly access their GPAs after each semester or academic year and deeply understand the academic significance these metrics convey. Educational administrators should provide academic warnings to lower-performing students, identify learning challenges, help students address problems promptly, adjust learning approaches, and utilize semester-by-semester GPA tracking to monitor academic progress and provide targeted growth recommendations. This transforms GPA from a static outcome measure into a dynamic tool supporting continuous improvement^[13].

7. Conclusion

As a crucial higher education management system, GPA serves multiple functions including facilitating students' personalized development, enhancing teaching quality, and optimizing the allocation of educational resources. Its educational management logic is student-centered, providing robust support for institutional teaching administration through dynamic evaluation, multidimensional assessment, and incentive-constraint mechanisms. However, implementation has revealed several issues, including excessive attribution of non-educational functions to GPA, students' utilitarian pursuit of grade points, weakened diagnostic and warning capabilities, and narrowed evaluation dimensions^[15].

To address these challenges, universities should implement corresponding measures to refocus on education's fundamental purpose, guide students in establishing proper learning perspectives, optimize academic evaluation

mechanisms, and promote transformational shifts in educational paradigms. These steps will enable GPA to fully realize its positive role as an academic assessment tool and advance the high-quality development of higher education.

Disclosure statement

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Redesigning and Exploring the Curriculum Framework for Human Resource Management under the New Liberal Arts Initiative

Jiangyong Liu*

Guangzhou Huashang College, Guangzhou 511300, Guangdong, China

**Author to whom correspondence should be addressed.*

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Abstract: As China's higher education transitions from extensive expansion to intensive development, the 'New Liberal Arts' concept has emerged as a pivotal strategic direction for transforming humanities disciplines. This approach emphasizes interdisciplinary integration, parallel development of theory and practice, and optimizing talent cultivation models guided by societal demands. The diversified economic structure and high-quality development trajectory of the Guangdong-Hong Kong-Macao Greater Bay Area present new demands for talent cultivation, curriculum design, and pedagogical reform within university Human Resource Management (HRM) programs. Taking Guangzhou Huashang College as the research subject, this paper analyses the core competencies required for HRM programs under the New Liberal Arts framework through policy document analysis, literature review, and field research. It identifies shortcomings in the current curriculum system regarding knowledge structure, practical pathways, and cross-disciplinary integration. Guided by Outcome-Based Education (OBE) and Competency-Based Education (CBE) frameworks, a new curriculum architecture was designed comprising four pillars: general education and humanities literacy, professional core competencies, cross-disciplinary integration, and practical innovation. Practical explorations were undertaken in areas such as university-enterprise collaboration and industry-education integration. Preliminary outcomes demonstrate that the new scheme comprehensively enhances students' data comprehension, strategic awareness, and humanistic sensitivity, providing a reference paradigm for the high-quality development of HRM programs within the new liberal arts context.

Keywords: New liberal arts development; Human resource management; Curriculum reform; Competency cultivation; Industry-education integration

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1. Introduction

In 2018, the Ministry of Education launched the 'Six Excellence and One Top Talent' Initiative 2.0, which for the first time proposed the parallel development of 'New Engineering, New Medicine, New Agriculture, and

New Liberal Arts’, marking the entry of higher education into a new era of structural transformation ^[1]. The development of the new liberal arts aims to integrate humanities and social sciences with modern technological capabilities, dismantle disciplinary barriers, and cultivate interdisciplinary talents possessing a sense of national and global responsibility, innovative spirit, and digital literacy. In 2020, the Declaration on the Development of New Liberal Arts was issued, further articulating the need to ‘ground efforts in the new era, adapt to emerging demands, and advance the integration, contemporary relevance, Sinicization, and internationalization of the liberal arts’ ^[2]. This provided a clear overarching blueprint for reforming humanities and social sciences programs.

Within human resource management, traditional curricula have long centered on organizational behavior, recruitment, employee training, and performance/compensation management. However, the widespread adoption of AI, big data, and cloud computing, coupled with organizational shifts towards platform-based and agile structures, has fundamentally altered corporate expectations for HR professionals. These now demand integrated competencies spanning data analytics, cross-cultural communication, and strategic support, moving beyond transactional execution ^[3]. Within the strategic Guangdong-Hong Kong-Macao Greater Bay Area, the rapid development of high-tech industries and modern services has created an urgent demand for professionals who are proficient in digital tools and possess strategic human resource thinking.

2. Literature review and theoretical foundations

2.1. Current state of research on new liberal arts development in China

In recent years, the ‘New Liberal Arts’ has emerged as a significant topic within educational research ^[4]. contends its core lies in dismantling disciplinary barriers to achieve integration between arts and sciences, thereby elevating both humanistic spirit and scientific literacy while shifting educational objectives from knowledge transmission to competency development ^[5]. Emphasizes that curriculum design should priorities student development, strengthen problem-driven and project-oriented approaches, and focus on cultivating critical and innovative thinking. Within business education, advocates embracing the digital wave by embedding technologies such as big data and AI into business talent development, forming an ‘Intelligence +’ model ^[5].

Regarding reforms in human resource management programs, stresses the need to transcend traditional functional boundaries, embracing new roles such as strategic partner, change agent, and employee experience optimizer, while strengthening content in data analytics and organizational development ^[6,7]. Recommends course design drawing upon the ‘HR three pillars’ framework (Centre of Excellence, HR Business Partner, Shared Service Centre) to enhance systematic coherence and practical applicability.

2.2. International reform experiences

Leading international institutions have widely adopted interdisciplinary integration in HRM education. The Wharton School at the University of Pennsylvania offers a specialization in ‘Behavioral Science and HRM,’ integrating neuroeconomics, organizational psychology, and big data analytics ^[8]. MIT Sloan’s ‘Human Resource Analytics’ course requires students to master Python and R for data modelling ^[9]. The London School of Economics (LSE) places greater emphasis on ‘Global Labor Markets and Policy’, incorporating legal, ethical, and equity considerations into its HR curriculum. The overarching trend can be summarized as ‘technology-enabled, data-driven, and ethically grounded’, with flexible course structures designed to respond to rapidly evolving industry demands.

3. Analysis of talent development objectives for human resource management within the new liberal arts paradigm

According to the China HR Capability Development White Paper published by the China Human Resources Development Association, corporate demands for human resource management professionals over the next five years will increasingly emphasize both multidisciplinary and specialized competencies ^[10]. Data analytics emerges as a critical skillset, with enterprises requiring HR practitioners to master tools such as Excel, SPSS, or Python for conducting quantitative analyses of metrics including employee turnover, performance, and remuneration to inform decision-making. The application of digital tools is also growing in importance, with HR professionals needing familiarity with HRIS, e-HR, and AI interview systems to adapt to digital transformation. Organizational development and change management capabilities are increasingly valued, encompassing organizational diagnosis, cultural shaping, and change facilitation to support corporate strategic adjustments and transformation. Additionally, enterprises emphasize interdisciplinary knowledge integration, requiring an understanding of industrial and organizational psychology, labor regulations, and data ethics. Humanistic literacy and communication coordination remain pivotal. HR professionals possessing empathy, cross-cultural communication skills, and employee care capabilities are better positioned to foster harmonious labor relations and enhance organizational cohesion. Collectively, these competencies form the core competency model for high-caliber HR talent in the new era. The Guangdong-Hong Kong-Macao Greater Bay Area stands as one of China's most economically dynamic and open regions, characterized by high-tech industries and modern services with pronounced outward-oriented economic features. According to Guangdong Provincial Bureau of Statistics, the Greater Bay Area hosted over 60,000 high-tech enterprises in 2022, with the digital economy accounting for more than 45% of GDP ^[11]. This industrial structure imposes heightened demands on HR professionals: technology firms like Huawei and Tencent priorities HR specialists with 'technology + management' expertise, requiring understanding of R&D processes and agile team management; Numerous Hong Kong, Macao, and multinational enterprises require HR professionals with bilingual proficiency, familiarity with international labor laws, and cross-cultural management expertise. Small and medium-sized enterprises (SMEs) and start-ups widely adopt new models such as flexible employment arrangements and equity incentives, urgently necessitating HR personnel with innovative and rapid response capabilities. Consequently, cultivating versatile HR talent aligned with regional industrial characteristics has become a key direction for professional reform in applied universities. As an applied undergraduate institution under Guangdong Province, Guangzhou Huashang University's Human Resource Management program should anchor its development in the educational positioning of 'regional service, practice orientation, and competency-based education'. It aims to cultivate high-caliber applied talents who are morally and professionally competent, possess solid foundations, strong practical abilities, innovative spirit, and an international outlook. Specific competency objectives include: proficiency in recruitment, training, performance management, compensation, and employee relations; foundational organizational diagnosis and human resource planning capabilities; mastery of at least one data analysis tool to process employee turnover, performance, and satisfaction metrics for decision support; strong communication, collaboration, and cross-departmental coordination skills; and an understanding of labor policy, employment systems, and corporate cultural differences within the Guangdong-Hong Kong-Macao Greater Bay Area, coupled with regional adaptability and cross-cultural management awareness. This framework aligns with the Greater Bay Area's developmental demands for high-tech industry concentration, diverse enterprise structures, and frequent talent mobility. It embodies the new liberal arts philosophy of 'integration, innovation, and application,' providing clear direction for curriculum restructuring ^[12].

4. Research and problem analysis of the existing curriculum framework

To accurately determine the starting point for curriculum reform, the project team conducted research in January 2025 on the human resource management program curricula at Guangzhou University of Business and Technology and five other applied universities in Guangdong Province (including Dongguan University of Technology City College and Guangdong University of Science and Technology). Employing a combination of questionnaire surveys, syllabus analysis, and corporate interviews, the following prominent issues were identified in the current curriculum framework.

4.1. Pronounced disciplinary barriers and insufficient interdisciplinary integration

The current curriculum for Human Resource Management remains centered on traditional management knowledge systems, exhibiting a rigidly phased structure.

- (a) Year 1 focuses on foundational courses such as Principles of Management, Microeconomics, and Organizational Behavior, emphasizing theoretical grounding
- (b) Year 2 introduces specialized modules including Introduction to Human Resource Management, Recruitment and Placement, Training and Development, establishing a preliminary professional framework
- (c) Year 3 concentrates on functional modules such as Performance Management, Compensation Management, and Labor Relations, deepening specialized skills;
- (d) Year 4 addresses career management and corporate culture, broadening professional perspectives.

Recruitment and Placement, and Training and Development to establish an initial professional framework. Year 3 concentrates on functional modules like Performance Management, Compensation Management, and Industrial Relations to deepen specialized skills. Year 4 incorporates extension courses such as Career Management and Corporate Culture alongside graduation internships, aiming to bridge theory and practice. However, interdisciplinary courses constitute less than 15% of the overall curriculum, with only sporadic offerings such as “Labor Law” and “Business Communication”. There remains a lack of deep integration with fields like data science (e.g., Python programming, statistics), psychology (e.g., industrial and organizational psychology), and information technology (e.g., HRIS). This course model, characterized by pronounced disciplinary barriers and a singular knowledge structure, leaves students ill-equipped to analyses complex management scenarios, such as digital transformation, organizational change, and employee experience design, from multiple perspectives or to synthesize solutions. Consequently, it struggles to meet the demands for cultivating versatile, innovative human resource management professionals within the new liberal arts paradigm ^[13].

4.2. Weak practical teaching components and insufficient university-industry collaboration

Although most universities incorporate practical teaching components such as ‘corporate internships’ and ‘graduation theses’ to enhance students’ operational capabilities, numerous issues persist in implementation. Firstly, internship durations are typically brief, often spanning only 8–12 weeks and predominantly concentrated in the final semester of undergraduate studies. This creates a significant disconnect from prior coursework, resulting in ineffective bridging between theoretical learning and practical application. Consequently, students struggle to systematically apply classroom knowledge to real-world work scenarios. Secondly, the value of internship positions is often limited. Students are frequently assigned to administrative support roles such as administrative assistance, document filing, and data entry, with scant opportunity to engage in core human resources functions like recruitment, training, performance appraisal, or employee relations management. This restricts the development and refinement of professional competencies. More critically, the depth and effectiveness of university-industry collaboration remain inadequate. Most partnerships remain superficial,

confined to signing agreements and establishing joint internship bases, lacking substantive collaborative mechanisms. These include co-developing course content, integrating corporate mentors into teaching, mutual faculty appointments, and jointly conducting human resource management research projects. Consequently, corporate resources fail to integrate effectively throughout the talent development process, significantly diminishing the educational impact of practical teaching. Student feedback indicates that over 60% of internships fail to enhance professional competencies ^[14].

4.3. Outdated curriculum content, lack of digitalization and cutting-edge topics

Currently, Human Resource Management programs predominantly utilize traditional authoritative textbooks such as Human Resource Management (Renmin University Press). While these texts offer comprehensive frameworks and robust theoretical foundations, they generally suffer from outdated content that struggles to reflect emerging industry trends. For instance, recruitment management courses predominantly focus on foundational techniques like CV screening and structured interviewing, with minimal coverage of emerging technologies widely adopted by contemporary enterprises. These include AI-powered interviews, talent profiling, big data-driven candidate matching, and social media recruitment (e.g., talent sourcing via LinkedIn or Maimai). Consequently, students lack awareness of modern recruitment practices. Regarding performance management, curricula predominantly feature traditional tools like KPIs (Key Performance Indicators) and MBOs (Management by Objectives), while offering insufficient coverage of contemporary performance models better suited to rapidly changing organizational environments. These include OKRs (Objectives and Key Results), agile performance management, and continuous feedback mechanisms, which have garnered significant attention in recent years. Furthermore, the professional curriculum lacks dedicated courses or modules systematically covering critical digital economy topics such as ‘Human Resources Data Analytics,’ ‘Employee Experience Design (EX),’ ‘Remote and Hybrid Team Management,’ and ‘Organizational Health and Psychological Safety.’ This leaves students inadequately equipped to address novel organizational structures and management challenges, failing to meet corporate demands for HR professionals with innovative thinking and technological application skills ^[15].

4.4. Monolithic assessment methods undervalue competency development

Existing course evaluation methods exhibit pronounced structural flaws, failing to align with contemporary talent development requirements. For years, most courses have relied predominantly on end-of-term closed-book examinations, which typically constitute over 60% of assessment weighting. This approach excessively emphasizes rote knowledge recall while neglecting students’ comprehension, application, and innovative capabilities. For instance, in practice-oriented courses such as Compensation Management, final examinations frequently center on textbook concepts. Students can achieve high marks through last-minute cramming, yet remain ill-equipped to address real-world challenges like compensation surveys or scheme design within actual enterprises. This highlights the disconnect between assessment methods and practical competency requirements. The absence of formative assessment mechanisms further exacerbates this issue. With coursework contributions typically below 40%, and some modules relying solely on final examinations, students fall into the trap of ‘slacking off during term time and cramming before exams,’ lacking sustained engagement with the learning process. For instance, in Statistics courses, evaluating performance solely through final examinations may cause students to overlook the processes of data collection, organization, and analysis. This hinders the mastery of practical statistical techniques, contradicting the ‘process-oriented, competency-based’ philosophy emphasized in the advancement of the new liberal arts ^[16].

The deepening development of the new liberal arts and the pursuit of high-quality regional economic

and social progress demand increasingly sophisticated, innovative, and multidisciplinary talents. Whether it be grassroots talent for rural revitalization who ‘understand agriculture, cherish the countryside, and care for farmers,’ or interdisciplinary technical professionals for the digital economy era, all require solid specialized knowledge, outstanding practical abilities, and sound innovative thinking. Yet the existing course assessment system remains entrenched in a traditional ‘knowledge-centric’ approach, failing to adequately evaluate students’ comprehensive competencies. A systematic overhaul is urgently needed. Consequently, reforming course assessment methods is imperative. On one hand, the weighting of end-of-term examinations should be appropriately reduced, while increasing the emphasis on formative assessment. This includes incorporating regular assignments, classroom discussions, and group projects into the assessment framework to guide students towards valuing the learning process. On the other hand, diverse evaluation methods must be expanded, introducing practical assessment tools such as case studies, simulation competitions, and field research to comprehensively evaluate students’ ability to apply knowledge, their innovative thinking, and their teamwork skills. Only through such measures can a talent cultivation quality evaluation system be established that aligns with the requirements of new liberal arts development and regional growth, thereby genuinely achieving the objectives of ‘promoting learning through assessment’ and ‘enhancing teaching through evaluation’.

5. Principles and approach for curriculum system reconstruction

Based on the aforementioned problem analysis, this study proposes a ‘three-dimensional integrated’ principle and implementation approach for curriculum system reconstruction.

5.1. Reconstruction principles

Four core principles have been established in the curriculum reconstruction process to ensure the forward-looking nature and effectiveness of talent cultivation. Firstly, it upholds the principle of multidisciplinary integration, transcending the boundaries of traditional single-discipline ‘management studies. It actively promotes deep integration between the Human Resource Management discipline and fields such as data science, psychology, law, information technology, and ethics. By establishing ‘interdisciplinary course modules’, it encourages students to select courses in statistics, computer fundamentals, industrial and organizational psychology, and related subjects. This fosters a ‘T-shaped’ knowledge structure characterized by ‘broad foundations and deep specialization’, enhancing comprehensive literacy and cross-boundary integration capabilities. Secondly, adhering to the Outcome-Based Education (OBE) principle, the curriculum is reverse-engineered from the twelve core competencies graduates must possess. Learning Outcomes for each course are explicitly defined and precisely aligned with specific competency metrics, ensuring teaching objectives are clear, measurable, and evaluable, thereby achieving closed-loop management in talent cultivation. Thirdly, the practice-driven principle is implemented by reinforcing the ‘learning by doing’ philosophy. Practical teaching components including project-based learning, real-world corporate case studies, and HR simulation exercises are substantially increased, raising the proportion of practical teaching credits to over 35%. This establishes a virtuous cycle of ‘theoretical learning-practical application-feedback optimization’. Finally, the principle of collaborative education between institutions and enterprises is implemented by deepening industry-education integration mechanisms. This involves engaging corporate mentors in teaching and project supervision, co-developing course content with industry partners, and jointly establishing practical projects. These measures foster dual-qualified teaching teams, ensuring teaching content aligns seamlessly with industrial frontiers, thereby substantially enhancing students’ job readiness and career development capabilities. These four principles mutually reinforce and organically unify, collectively forming a

robust foundation for curriculum reform within the new liberal arts framework ^[17].

5.2. Design approach

Table 1. Curriculum stage design based on progressive competency development

Academic Year	Course Stage	Design Objectives	Primary Teaching Strategies and Curriculum Content
Year One	Foundation in General Education and Humanities Literacy	Strengthening critical thinking, communication skills, ethical awareness and digital literacy	Offering courses such as ‘Introduction to the New Liberal Arts’, ‘Logic and Critical Thinking’, ‘Business Ethics’, ‘Cross-Cultural Communication’ and ‘Fundamentals of Data Literacy’, with emphasis on cultivating humanistic depth and foundational competencies.
Academic Year	Building Foundational Professional Competencies	Systematically master the core knowledge framework of human resource management	Systematically study six key modules: recruitment, training, performance management, compensation, labor relations, and career development. Utilize case-based teaching and group discussions to consolidate foundational expertise.
Year Three	Interdisciplinary Competence Development	Enhancing Comprehensive Application and Cross-disciplinary Integration Skills	Courses including Human Resource Management, Marketing, Special Topics in Professional Awareness and Management Frontiers, and Introduction to Human Resource Management are introduced to broaden strategic perspectives and strengthen multi-disciplinary integration capabilities.
Year Four	Practical and Innovative Capability Enhancement	Achieving Knowledge Integration, Competency Output and Career Transition	Through collaborative industry workshops, corporate placements, graduation projects and innovation competitions, students undertake real-world enterprise projects to demonstrate integrated competency application and deliver tangible outcomes.

Note: This table illustrates a ‘modularized and tiered’ curriculum structure design, adhering to a progressive logic of ‘general education–foundational studies–advanced studies–practical application’. It emphasizes the phased and developmental nature of competency cultivation, aligning with the principles of Outcome-Based Education (OBE) and the requirements for cultivating applied talents under the New Liberal Arts initiative ^[18].

5.3. Innovation in teaching methods

Table 2. Innovative teaching methods and their implementation to support competency development objectives

Teaching Methods	Specific Implementation Methods	Application Scenarios and Objectives
Project-Based Learning (PBL)	Each semester features 1–2 real-world human resource management projects sourced from enterprises, such as ‘Optimizing Recruitment Processes for a Specific Company’ or ‘Employee Satisfaction Surveys and Improvement Plans’. Students work in groups to conduct research, analyze data, design solutions, and submit reports.	Develops students’ ability to solve authentic management challenges while enhancing teamwork, project management, and professional practice skills.
Flipped Classroom	Prior to lessons, micro-lecture videos, reading materials and preparatory tasks are provided via online platforms; classroom time is primarily dedicated to problem discussions, case studies, role-playing and practical exercises.	This enhances students’ autonomous learning capabilities, increases classroom interactivity and engagement, and promotes knowledge internalization and deep learning.
Digital Tool Integration	Courses such as Human Resource Data Analysis, Compensation Management, and HR Information Systems systematically incorporate practical training modules including advanced Excel functions, foundational SPSS statistical analysis, Python data processing, and HRIS system simulations.	This enhances students’ digital literacy and technical application capabilities, equipping them with the core tools and skills required for modern HR roles.
Corporate Mentorship Program	Corporate HR directors, organizational development (OD) specialists, and compensation and performance consultants are invited to serve as guest lecturers or project mentors. They participate in curriculum co-development, deliver specialized lectures, provide project guidance, and evaluate outcomes.	This achieves deep industry-education integration, enhancing teaching practicality and foresight while helping students understand industry dynamics and professional requirements.

Note: Through systematic innovation in the aforementioned four teaching methodologies, a dynamic, open curriculum ecosystem responsive to industry shifts has been established. This effectively underpins the talent development objectives of the Human Resource Management program within the New Liberal Arts framework, characterized by a competency-oriented, practice-driven approach.

6. Curriculum framework restructuring proposal design

6.1 Curriculum module design

Table 3. Restructured curriculum modules and competency focus in the human resource management major

Module	Course Title (Partial)	Credits	Competency Focus
Module One: General Education and Humanities	Introduction to the New Liberal Arts, Logic and Critical Thinking, Business Ethics, Intercultural Communication, Foundations of Data Literacy	18	Humanities literacy, communication skills, digital awareness
Module Two: Foundational Professional Courses	Principles of Management, Organizational Behavior, Introduction to Human Resource Management, Recruitment and Placement, Training and Development, Performance Management, Compensation Management, Labor Relations Management	28	Professional Core Competencies, Systems Thinking
Module Three: Interdisciplinary Expansion Courses	Human Resource Data Analysis (including Python Fundamentals), Organizational Development and Change Management, Industrial and Organizational Psychology, Labor Policy and Regulations (including Comparative Analysis of Hong Kong and Macau Labor Laws), HR Information Systems (HRIS)	20	Data Competence, Interdisciplinary Integration, Strategic Vision
Module Four: Practice and Innovation	HR Project-Based Training (Year 3), Corporate Internship (Year 4), Graduation Project, Innovation and Entrepreneurship Practice, HR Case Competition	24	Practical Skills, Innovative Spirit, Team Collaboration

Total credits: 160 credits (including 56 practical credits, accounting for 35%)

6.2. Specialized course description

Following the restructuring of the curriculum, a range of interdisciplinary and innovative courses have emerged as highlights, reflecting the program's exploratory achievements in transformation and upgrading within the context of the new liberal arts. For instance, Human Resource Data Analysis is designated as a core cross-disciplinary course, carrying 3 credits and 48 contact hours. The module guides students through data pre-processing, descriptive statistics, correlation testing, and regression modelling, demonstrating these methodologies' application in HRM. Practical sessions utilize Python and Pandas libraries for case studies on employee attrition prediction, thereby enhancing data literacy and analytical skills.

Another course, Organizational Development and Change Management (2 credits, 32 hours), introduces classic OD theories such as Lewin's three-stage model and Kotter's eight-step approach. It combines these with practical case studies involving corporate mergers, organizational restructuring, and digital transformation to cultivate students' diagnostic and intervention capabilities in complex organizational change scenarios^[19].

HR Project-Based Training is an intensive practical course totaling 4 credits over 8 weeks. Students complete real-world assignments from partner enterprises in teams, such as 'Corporate Culture Assessment,' 'Performance System Optimization,' or 'Recruitment Process Redesign.' Enterprise mentors and academic staff provide continuous guidance, enabling students to hone their skills within authentic business environments. Additionally, the Labor Policy and Regulations module features a specialized section on 'Comparative Labor Systems in the Guangdong-Hong Kong-Macao Greater Bay Area'. This systematically analyses institutional differences across mainland China, Hong Kong, and Macao concerning employment contracts, working hours, social security, and dismissal protections, equipping students to navigate diverse regional employment landscapes^[20]. Overall, this curriculum framework preserves the core strengths of HRM while emphasizing the design principles of 'solidifying foundations, broadening domains, strengthening practice, and driving

innovation.’ It deeply integrates data science, organizational theory, and regional practice, aligning with the interdisciplinary and forward-looking nature of new liberal arts development, and demonstrates strong scalability ^[21].

7. Practical exploration and case analysis

In January 2025, the project team conducted a questionnaire survey among HRM students regarding the new curriculum framework, collecting 108 valid responses. Findings revealed strong student endorsement of the revised structure. Data indicates that 87% of students perceive the restructured curriculum as ‘more closely aligned with practical workplace demands,’ significantly enhancing learning utility and purpose; 76% explicitly stated their ‘data analysis capabilities had markedly improved,’ demonstrating the effectiveness of interdisciplinary course design in cultivating technical literacy. Particularly regarding practical components, 91% of students expressed satisfaction with ‘corporate project placements,’ viewing this as an effective bridge between theoretical knowledge and practical application. Overall, students’ comprehensive satisfaction with this curriculum reform reached 89.3 points (out of 100), indicating high acceptance and positive feedback. Additionally, the project team conducted interviews with industry mentors ^[22]. Participating mentors offered positive evaluations, consistently noting that ‘student proposals were data-driven, logically coherent, and demonstrated nascent professional consultancy capabilities.’ This confirms the teaching reform has achieved substantive progress in enhancing students’ professional thinking and practical skills. Industry mentor feedback: ‘Student proposals were data-driven, logically coherent, and demonstrated nascent professional consultancy capabilities.’

8. Effectiveness evaluation and reflection

8.1. Effectiveness evaluation indicator system

Establish a multi-dimensional evaluation system based on OBE (as shown in Table 4):

Table 4. Multi-dimensional evaluation system for talent training quality in HRM major based on OBE concept

Dimension	Indicator	Data Source
Knowledge Mastery	Course GPA, Core Course Pass Rate	Academic Management System
Capability Enhancement	Quality of HR data analysis reports, project defense scores	Faculty evaluations
Practical Outcomes	Internship host evaluations, project adoption rates	Corporate feedback
Student Development	Employment rates, professional alignment rates, progression rates	Employment Office data
Social Recognition	Employer satisfaction, competition awards	Survey questionnaires

8.2. Key outcomes

During the research and design phase of the curriculum restructuring initiative, the project garnered multifaceted positive feedback and achieved anticipated outcomes. Surveys indicate widespread endorsement of the restructuring plan among academic staff, students, and industry experts, with particularly high ratings for its emphasis on practical teaching and alignment with industrial demands. Questionnaire and interview findings reveal that over 85% of teaching staff believe the new curriculum structure enhances students’ comprehensive competencies; among corporate participants, nearly 80% deemed the curriculum highly aligned with industry

development requirements. Retrospective employment data also indicates anticipated improvements in the employability and job suitability of the 2024 cohort, with significantly heightened willingness to pursue specialization-related careers. Enterprises fully endorsed the program's focus on cultivating graduates' 'data analysis capabilities' and 'problem-solving skills', demonstrating the scientific rigor and practical feasibility of the restructuring plan in developing core competencies^[23].

8.3. Existing shortcomings

Despite broad endorsement during the research phase, the implementation process faces several potential challenges. Firstly, teaching staff exhibit gaps in interdisciplinary instructional capabilities. Some faculty members have yet to fully master tools such as Python and SPSS required for courses like Human Resource Data Analysis, necessitating systematic training to enhance teaching delivery. Secondly, the scope of industry-academia collaboration remains limited, particularly in resource integration with enterprises in Hong Kong and Macau. Opportunities for students to engage in cross-border practical placements and international projects are scarce, constraining the effectiveness of regional collaborative education. Thirdly, course resource development is still in its infancy. Some newly established courses, such as Organizational Development and Change Management, lack mature teaching materials and currently rely heavily on self-compiled handouts, hindering the standardization and scalability of teaching content. Finally, the competency assessment mechanism remains imperfect. Existing evaluations predominantly rely on subjective judgements, lacking scientific, unified quantitative tools to objectively measure students' comprehensive abilities^[24].

8.4. Directions for improvement

Addressing the aforementioned issues, future improvements will advance through four key areas: Firstly, establishing an 'HR Teaching Innovation Team' to regularly organize interdisciplinary teaching and research activities, enhancing faculty teaching capabilities in data analysis, organizational psychology, digital technology, and related fields; Second, actively expanding collaborative networks with universities and enterprises in Hong Kong and Macao to establish a Greater Bay Area Human Resources Education Alliance, facilitating the sharing of course resources and practical platforms; Third, accelerating the development of school-based course resources by systematically creating syllabuses, teaching cases, and practical training manuals, alongside building an online 'New Liberal Arts HR' course platform to enable digital sharing of high-quality resources; Fourthly, introducing internationally recognized third-party competency assessment tools, such as SHL and TalentQ, to conduct standardized evaluations of students' key competencies, thereby enhancing the scientific rigor and credibility of talent cultivation quality assessments. Through continuous optimization, further strengthening the adaptability and forward-looking nature of the curriculum system.

9. Conclusions and recommendations

The innovation of this research manifests in three key aspects. Firstly, it translates the macro-strategic concept of New Liberal Arts development into concrete, actionable implementation plans. By scientifically constructing course modules and a corresponding competency assessment framework, it successfully integrates the core tenets of interdisciplinary integration, competency-oriented development, and practical innovation advocated by the New Liberal Arts into the HRM curriculum development process, achieving an effective transition from conceptual guidance to practical implementation. Secondly, the study establishes an integrated teaching model encompassing 'theoretical learning–practical training–project application', effectively resolving the traditional

disconnect between theory and practice. By incorporating authentic corporate projects, implementing project-based teaching methodologies, and intensifying process-oriented practical training, students' comprehensive application skills and problem-solving abilities are significantly enhanced. This approach genuinely achieves the talent development objective centered on competency output. Thirdly, this research fully leverages the distinctive regional development characteristics of the Guangdong-Hong Kong-Macao Greater Bay Area. By incorporating teaching content with regional distinctiveness—such as comparative labor policies between mainland China and Hong Kong/Macao, and cross-cultural human resource management into curriculum design, it has effectively enhanced the regional relevance and practical service efficacy of professional education. This fully demonstrates the responsibility and commitment of applied universities to serving local economic and social development ^[25].

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Exploration and Practice of the Application of Eye-Tracking Technology in University Mathematics Teaching

Zejun Wang¹, Mei Yang^{1*}, Xingjing Fan¹, Mingyang Li²

¹School of Science and Arts, China University of Petroleum-Beijing at Karamay, Karamay 834000, Xinjiang, China

²University of Chinese Academy of Sciences, Beijing 100049, China

**Author to whom correspondence should be addressed.*

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Abstract: As a tool for quantifying individuals' visual attention and information processing, eye-tracking technology is gradually being applied in the reform of higher education. This paper focuses on issues in university mathematics teaching, such as heavy cognitive load, delayed feedback, and insufficient adaptability. Based on theories of cognitive psychology, the study explores application pathways of this technology in cognitive diagnosis, instructional optimization, classroom regulation, personalized support, and teaching assessment. Research shows that eye-tracking data can reveal key cognitive features during the learning process, enhance the visualization of instructional feedback, and improve the scientific basis of decision-making. This provides both theoretical support and practical reference for data-driven and precise transformation in university mathematics education.

Keywords: Eye tracking; University mathematics; Teaching reform; Data driven

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1. Introduction

University mathematics, as a core component of the foundational curriculum in higher education, plays a critical and unique role in cultivating students' logical thinking, abstract reasoning, and mathematical modeling competence. However, for a long time, the teaching of this course has commonly faced practical challenges such as abstract content, delayed feedback, and learning difficulties. The traditional lecture-based teaching model emphasizes knowledge transmission while neglecting cognitive processes. Students often lack timely feedback and effective support during learning, resulting in difficulties understanding, keeping up with, and mastering the material, factors that significantly impact teaching quality and learning outcomes.

With the rapid advancement of educational information technologies, an increasing number of researchers have begun to explore the potential of these technologies in instructional reform ^[1]. Eye-tracking technology, which can record individuals' visual attention behavior in real time, has recently gained growing attention in

the field of education ^[2,3]. This technology captures key data such as learners' gaze positions, fixation durations, and visual scan paths during learning, uncovering their cognitive processes in receiving, processing, and understanding information. Compared to traditional methods like tests and questionnaires, eye-tracking data offers greater objectivity, real-time insights, and visual representation, opening new avenues for identifying learning difficulties and optimizing instructional feedback ^[4].

At present, eye-tracking technology has shown promising applications in areas such as language learning, science experiments, and programming education. However, its use in university mathematics education is still at an early stage, with related practices remaining fragmented and lacking systematic exploration. Therefore, this study focuses on university mathematics courses and attempts to integrate eye-tracking technology into teaching reform. By targeting key aspects such as cognitive diagnosis, instructional design, classroom feedback, and personalized support, it explores effective application pathways for enhancing teaching quality and efficiency. The aim is to shift teaching from experience-driven to data-driven, thereby promoting high-quality development in higher education.

2. Technological background and theoretical foundations

2.1. Principles of eye-tracking technology and its educational applications

Eye-tracking technology is a behavioral research tool that analyzes individuals' visual attention and cognitive processes by recording eye movement trajectories ^[5]. The basic principle involves using infrared camera systems to capture changes in eye position during visual fixation and calculating gaze points through algorithms to generate data such as gaze paths and heat maps. Common eye-tracking indicators include fixation points, fixation duration, regression rate, and pupil diameter changes. These variables collectively reflect how individuals allocate attention and experience cognitive load while processing visual information ^[6].

In educational settings, eye-tracking technology enables the visualization and quantification of the learning process, effectively compensating for the traditionally unobservable aspects of student learning behavior in the classroom ^[7]. By defining Areas of Interest (AOIs) within instructional materials, researchers can perform quantitative analyses on students' gaze behavior in specific content regions. This allows for assessment of their attention to key concepts and identification of comprehension difficulties, providing real-time feedback to inform instructional design.

2.2. Cognitive psychology foundations for instructional optimization

The effective application of eye-tracking technology in teaching relies on robust cognitive theories as interpretive frameworks. Among them, Cognitive Load Theory is widely utilized in instructional design ^[8]. This theory posits that individuals have limited working memory capacity during learning. If instructional materials are poorly designed and exceed this capacity, learning efficiency deteriorates. Cognitive load is categorized into intrinsic, extraneous, and germane load. Extraneous load, which is mainly influenced by how information is presented, is a key variable that can be regulated through instructional design. Eye-tracking data provides a quantifiable method for dynamically assessing cognitive load. Educators can use this data to redesign content and better manage students' cognitive load, thereby enhancing learning outcomes (details in **Figure 1**).

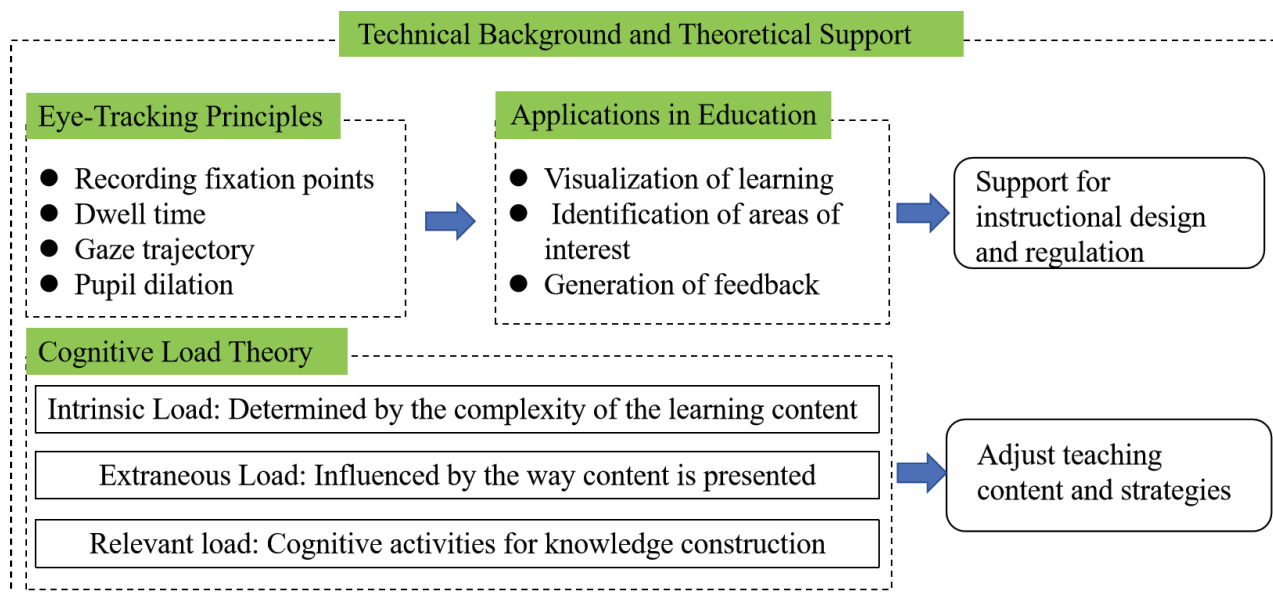


Figure 1. Applying eye-tracking technology and cognitive load theory.

3. Exploratory practice in teaching reform

This study attempts to integrate eye-tracking technology into mathematics teaching reform. By combining real classroom scenarios, it explores application pathways in areas such as instructional design optimization, classroom regulation, personalized support, and dynamic feedback, aiming to enhance teaching precision and learning effectiveness.

3.1. Accurately identifying students' cognitive barriers

Eye-tracking technology can be used to identify cognitive bottlenecks students encounter during the learning process. Focusing on key topics in Advanced Mathematics such as the definition of limits, definite integrals, and Taylor series, students were tasked with browsing courseware, watching instructional videos, and completing example problems. Their gaze paths and fixation durations were recorded using screen-based eye trackers. The analysis revealed that during multi-step derivations, students often displayed abnormally prolonged fixations at the proof steps of limits, indicating a high cognitive load. Additionally, frequent gaze shifts between diagrams and formulas suggested an unstable connection between geometric imagery and algebraic expressions. Although visual cues were present in the courseware, students' attention remained focused on textual descriptions while neglecting critical formulas and diagrams, exposing inefficient information extraction strategies and goal misalignment.

3.2. Optimizing the design and presentation of instructional content

Eye-tracking technology can provide effective feedback for instructional content design, helping teachers identify students' attention patterns and information processing characteristics, thereby optimizing content presentation and enhancing guidance.

In courseware design, content is no longer presented all at once but is broken down into step-by-step derivations with dynamic annotations. Complex formulas and reasoning processes are divided into logical units and displayed sequentially with animations to help students understand at a cognitive pace. Critical variables,

conclusion points, and easily confused segments are highlighted using visual means such as color, font, and graphics to focus attention on core information, reduce cognitive load, and prevent distraction.

Teaching strategies have also shifted from concept-first approaches to problem-oriented and context-based introductions. By presenting real-world mathematical problems, students are guided to naturally transition into knowledge formation during the problem-solving process, enhancing goal awareness and structural learning. This “learning through application” approach aligns better with students’ cognitive development and supports knowledge construction and transfer.

3.3. Establishing a dynamic classroom feedback mechanism

Embedding eye-tracking technology into classroom teaching enables real-time perception of students’ learning states and dynamic regulation of instructional pacing. Using portable eye-tracking devices, the gaze behaviors of selected students were monitored during class.

When a particular topic elicited short fixations or frequent regressions in the corresponding courseware area among most students, the teacher could infer comprehension difficulties and respond by slowing down, adding examples, or facilitating immediate Q&A sessions. Teachers could also adjust blackboard writing order and content layout based on students’ gaze paths to better match the rhythm of information intake.

This mechanism enables real-time, data-driven instructional feedback, moving away from one-way lecture-based models and significantly improving the interactivity and adaptability of teaching.

3.4. Supporting personalized learning resource recommendations

Eye-tracking technology has the potential to reveal learners’ cognitive styles and information processing preferences, providing data support for personalized learning resource recommendations.

For instance, students whose gaze paths concentrate on dynamic visual areas and exhibit smooth eye movements tend to prefer image-oriented materials, while those with longer fixations on text or formula regions may be more suited to logic-based learning approaches. Based on such eye-tracking features, students can be matched with resources that better align with their cognitive styles, such as interactive diagrams, structured derivation tasks, or concept map navigation, thereby improving learning efficiency and motivation.

3.5. Facilitating teacher reflection and professional development

Eye-tracking can also serve as a tool for supporting teachers’ professional development. By recording teachers’ gaze behaviors during lesson preparation and delivery, such as courseware browsing, blackboard writing, and student interactions. Thus, teachers can analyze attention distribution to identify blind spots and habitual behaviors in their instruction.

The analysis showed that some teachers overly focused on lecture notes during class, paying insufficient attention to students’ facial expressions and reactions, which may hinder classroom interaction. By reviewing their own eye-tracking recordings, teachers can visually perceive these issues and consciously adjust their attention distribution strategies in future classes, thereby enhancing responsiveness and teaching flexibility.

4. Reflections and insights on teaching reform

Based on the preceding teaching practices and reflections, this paper summarizes four systematic and forward-looking insights for educational reform (see **Figure 2**).

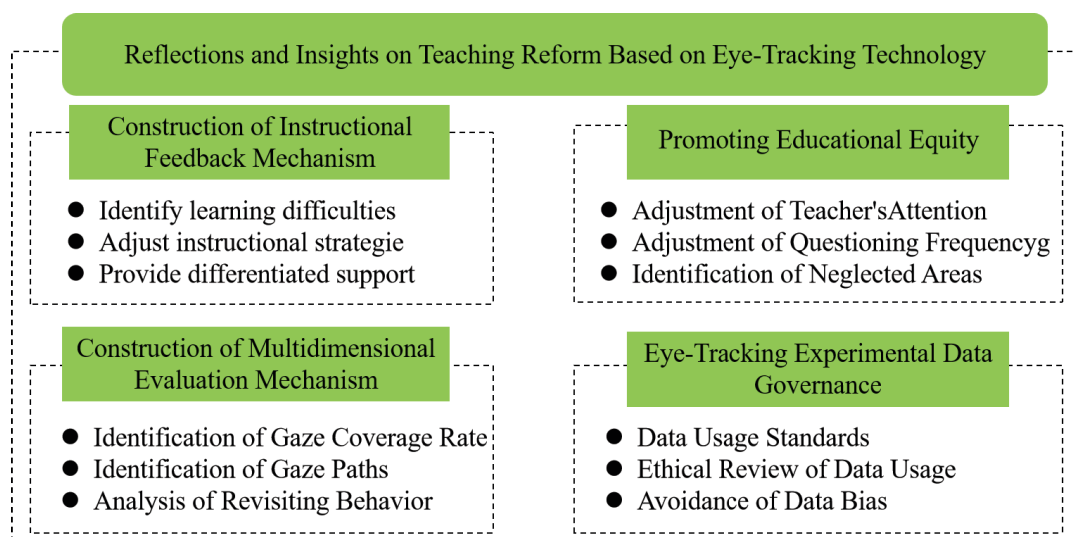


Figure 2. Framework diagram of reflections and insights on teaching reform.

4.1. Building a cognition-visualized teaching feedback mechanism

For a long time, the learning process has been regarded as a cognitive black box, with teachers often relying on experience-based judgment to assess student understanding, making precise intervention difficult. The introduction of eye-tracking technology enables the quantification, visualization, and analysis of students' visual attention behaviors during learning, providing new possibilities for constructing effective teaching feedback mechanisms^[9].

Teachers can utilize historical eye-tracking data to identify instructional difficulties before class, use real-time feedback to adjust teaching strategies during class, and offer differentiated support based on individual gaze patterns after class. This facilitates a shift from experience-driven to data-driven instruction, enhancing the adaptability of teaching and the relevance of student learning. Ultimately, it promotes the transformation of classroom instruction toward precision and intelligence.

4.2. Promoting equity and ethical decision-making in teaching

Teaching is not only a cognitive activity but also involves the distribution of ethical values. A teacher's attention distribution, frequency of questioning, and interaction patterns can lead to differentiated impacts on students. Eye-tracking data provides a quantitative basis for revealing these potential inequalities.

By analyzing the distribution of teachers' gaze behavior in class, it is possible to uncover tendencies such as disproportionate attention to active students or the neglect of average or quiet students. This data-driven reflection mechanism helps teachers balance efficiency with fairness in instructional decision-making, fostering ethical awareness and creating a more inclusive, diverse, and equitable teaching environment.

4.3. Developing a process-oriented, multi-dimensional evaluation system

Current evaluation systems in university mathematics education largely focus on summative outcomes, neglecting students' cognitive efforts and strategic changes throughout the learning process. Eye-tracking technology provides a practical data foundation for constructing process-oriented evaluation mechanisms. By analyzing students' gaze behaviors during courseware browsing, video learning, and problem-solving, key evaluation indicators can be extracted, such as fixation coverage on core content, logical consistency of gaze paths, frequency of regressions, and distribution of fixation durations. These indicators can not only inform teachers' instructional adjustments but also serve as feedback for students to optimize their learning strategies.

4.4. Addressing ethics and data governance in educational technology applications

When using eye-tracking devices to collect data on students' learning processes, safeguarding their privacy, data security, and informed consent becomes an unavoidable issue in technological applications. Higher education institutions should establish clear data usage protocols and ethical review mechanisms to ensure that students participate in data collection voluntarily and with full knowledge. Furthermore, when using eye-tracking data for assessment or categorization, care must be taken to avoid replacing individual understanding with data labeling, thereby preventing the emergence of new forms of digital bias. Only by finding a balance between technological rationality and humanistic care can the healthy and sustainable development of educational technology truly be achieved.

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Research on the Reform of the “Ecotourism” Course Based on the OBE Concept in the Context of Intelligent Education

Wei Xing¹, Haiwei Liang^{2*}, Xiao Li¹, Xiang Li¹

¹School of Economics and Management, Sanming University, Sanming 365004, Fujian, China

²School of Education and Music, Sanming University, Sanming 365004, Fujian, China

**Author to whom correspondence should be addressed.*

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Abstract: Under the background of intelligent education, the traditional teaching model of “ecotourism” has become increasingly problematic and is no longer able to meet the needs of talent cultivation. Based on the OBE (Outcomes-Based Education) concept, this study explores the necessity, pathways, and methods for the reform of the “ecotourism” course. By reconstructing the teaching objective system oriented towards student learning outcomes, optimizing teaching content and methods, and innovating the evaluation mechanism; and by integrating teaching resources with intelligent education technologies to build a blended online-offline teaching model, the course can better meet industry needs and student development, thereby cultivating high-quality talents that can adapt to the new era of ecotourism development.

Keywords: Intelligent education; OBE concept; “Ecotourism” course

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1. Introduction

With the development of information technology, intelligent education, as an emerging model, is driving the transformation of traditional education. The “14th Five-Year National Information Plan” has proposed that education and teaching should integrate intelligent and information technologies ^[1,2]. Intelligent education is student-centered. Teachers create intelligent teaching models through information technology means to form a personalized, intelligent, and experiential learning environment, which greatly enriches teaching methods and learning resources. However, this requires students to have the ability of lifelong learning. The OBE (Outcome-Based Education) concept, which is also student-centered and outcome-oriented. It emphasizes starting from the needs of students and determining what teachers “teach” through what students “learn” to enable students to master knowledge and skills ^[3,4]. Therefore, the OBE concept can promote the reform and improvement of intelligent teaching models ^[5].

“Ecotourism” is one of the core courses in the tourism management major of universities. However, the

traditional teaching model suffers from problems, such as the disconnection between theory and practice, the misalignment between content and industry needs, and a singular evaluation system, which makes it difficult to meet the talent cultivation needs of the information age ^[6,7]. Intelligent education, with the help of technologies, such as artificial intelligence and big data, can achieve precise teaching and personalized learning, providing an innovative path for course reform ^[8]. The OBE concept, which is oriented towards student learning outcomes, helps to clarify teaching objectives, improve teaching methods, and perfect the evaluation system ^[9]. The combination of the two provides a theoretical framework and practical approach for the reform of the “Ecotourism” course.

Taking “ecotourism” as an example, this paper combines intelligent education with the OBE concept to reform course teaching. By optimizing teaching content, enriching teaching methods, and innovating the evaluation system, the traditional model that “emphasizes theory but neglects practice” is changed. A teaching model centered on student development is constructed, thereby improving the teaching quality of the “ecotourism” course.

2. Current status of “ecotourism” course teaching

Ecotourism is an emerging course with strong comprehensiveness and practicality, involving multiple disciplines, such as ecology, tourism studies, and geography ^[7,8]. It is characterized by its integrative, practical, and innovative nature. With the advancement of ecological civilization construction, especially the impetus of policies like “National Parks” and the “Two Mountains Theory,” the content and practice of this course are continuously being updated. The teaching content and focus need to be adjusted in line with the times so that students can grasp the current issues in the ecotourism industry and their solutions. However, there are still some pressing problems that need to be solved in actual teaching.

2.1. Relatively outdated teaching content

The content of “ecotourism” textbooks is updated lagging behind. Teachers mostly continue to use old textbooks, presentations, and data, which led the students’ understanding of ecotourism stuck in the past. However, the field of ecotourism is constantly evolving, with new content and practical cases emerging frequently. This results in a significant gap between what students learn and what is actually applied. For example, current textbooks have not supplemented content related to the construction of national parks in China.

2.2. Outdated teaching methods, concepts and weak practical components

The teaching of the “Ecotourism” course often relies on traditional lecture methods, with teachers as the dominant force, neglecting the students’ principal status. Moreover, it places excessive emphasis on basic theory while undervaluing the cultivation of practical skills. As a result, students’ enthusiasm is low, classroom interactivity is poor, and their interest and initiative in learning are hard to arouse. Additionally, many universities lack sufficient practical teaching resources and partnerships with ecotourism companies for internship bases, limiting students’ practical opportunities and causing a disconnect between theory and practice.

2.3. Singular teaching evaluation method

The assessment of the “ecotourism” course mainly relies on the final theoretical examination, with a singular set of evaluation criteria. Taking our university as an example, the course assessment is based on attendance and the final exam score (accounting for 80%). Students can achieve good grades by rote memorization, but they tend to forget the content quickly after the exam, as they have not deeply understood the knowledge. This one-sided evaluation method fails to comprehensively reflect students’ learning outcomes and capability development, and

is not conducive to objectively and fairly assessing students

3. The necessity of reforming the “ecotourism” course in the context of intelligent education

With the advancement of information technology, intelligent education has become a development trend in modern education ^[10,11]. Intelligent education integrates technologies such as artificial intelligence, big data, and cloud computing which provide a wealth of teaching methods and learning resources for education, and constructing an innovative educational model ^[12,13]. In this context, the reform of the “ecotourism” curriculum has significant practical significance and necessity.

Ecotourism is the practice of the sustainable development concept in the tourism field. With the impetus of policies such as China's "National Park System" and the "Two Mountains Theory," the content and practical models of the "ecotourism" curriculum have been continuously evolving. However, traditional course content lags behind industry development and fails to meet the needs of students for cutting-edge knowledge and high-quality talent cultivation. In contrast, intelligent education offers abundant resources and diverse methods for curriculum reform. Teachers can upload short videos and practical case studies to intelligent platforms for students' self-directed learning. Meanwhile, by leveraging virtual simulation technology and project-based practical teaching methods, a realistic learning environment can be created for students to facilitate knowledge acquisition and application. Therefore, intelligent education provides technological support and innovative ideas for the reform of the "ecotourism" curriculum. By optimizing the teaching process, it can better meet the needs of high-quality talent cultivation in the ecotourism industry.

4. Reform ideas for “ecotourism” course teaching based on the OBE concept

The OBE concept, which is student-centered and outcome-oriented, has become an effective approach to enhancing teaching effectiveness and talent-cultivation quality by designing the teaching process in reverse and innovating teaching methods through the use of modern technological means^[14]. Integrating the OBE concept, into the teaching of “ecotourism” and guiding students’ learning process is the key to promoting curriculum reform. This paper takes students’ graduation requirements and professional practice as the starting point, designs the course system in reverse, optimizes the course syllabus and objectives, adjusts the teaching content and models, and improves the diversified evaluation system to facilitate students’ capability enhancement and goal achievement (**Figure 1**), thereby constructing an intelligent teaching model for the “ecotourism” course.

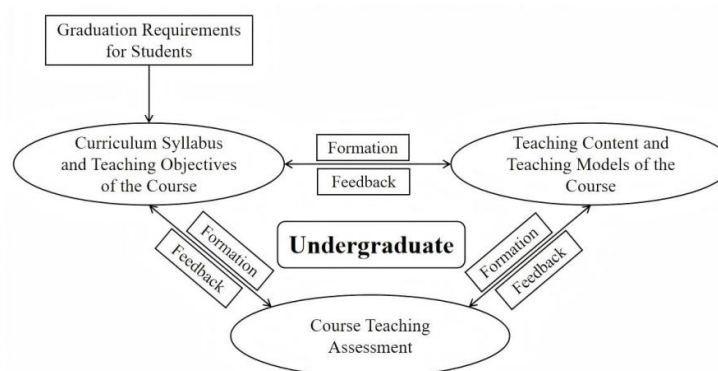


Figure 1. Overall plan for the teaching reform of the ecotourism course.

4.1. Outcome-oriented, revision of syllabus and teaching objectives

Under the OBE concept, in combination with the needs of the nation, industry and society, and in accordance with the requirements for student development and professional talent cultivation, the syllabus for the “ecotourism” course has been revised to clarify the course objectives and carry out teaching activities. The revision includes the following aspects: Firstly, in terms of learning objectives, emphasis is placed on the cultivation of students’ practical abilities, with the integration of ideological and political education elements to achieve the unity of knowledge transmission and value guidance. Secondly, regarding the allocation of class hours, the combination of theory and practice is optimized, and the class hours for different chapters are adjusted. Online resources are provided through intelligent teaching platforms, and interactive teaching methods such as group discussions and case analyses are adopted to enhance teaching interaction and increase student participation. Thirdly, cooperation with local ecological tourist attractions is established to organize student field investigations and research, thereby applying the knowledge learned to practice. Finally, a diversified and process-oriented assessment system is constructed. Elements such as online learning, classroom interaction, group presentations, and assignment completion are included in the process-based assessment, while the weight of the final exam is reduced. This approach is designed to motivate students’ initiative in practical learning and to promote the improvement of their overall quality and practical abilities.

4.2. Student-centered, optimization of course resources and innovation of teaching methods

The content of the “ecotourism” course is closely linked to social development. In order to enhance the teaching effectiveness, it is necessary to systematically integrate and optimize the teaching content based on the OBE concept. Firstly, be bold in innovation and expand teaching resources. In addition to the fixed textbooks, it needs to deconstruct and reconstruct the teaching content, design the knowledge points meticulously, highlight case-based teaching in combination with the current state of social and economic development, and closely connect the teaching content with the development of the discipline and social needs. Secondly, delve into case studies to enrich the teaching content. Update the teaching content according to the development needs of ecotourism, and introduce new theories and local cases such as “China’s National Park Construction” and “The Two Mountains Theory” to stimulate students’ interest. Finally, center on students and innovate teaching methods. Adopt a blended online/offline teaching model, use intelligent education platforms to flexibly arrange learning time and content, monitor students’ learning progress and effectiveness in real-time, and precisely adjust the offline teaching segments. Additionally, employing teaching strategies such as the flipped classroom, seminar-style teaching, and case-based instruction, this study explore interactive methods between teachers and students to enhance the classroom’s interest and appeal, and gradually build an efficient “ecotourism” teaching system.

4.3. Using diversified assessment as a means to improve the teaching evaluation system

Under the OBE concept, course evaluation needs to leverage the leading role of teachers and the principal role of students, establishing a diversified evaluation system that includes teacher assessment, peer assessment among students, and self-assessment by students. A combination of process-oriented evaluation and final examination is adopted to strengthen process management and reduce the weight of the final exam. Process-oriented evaluation covers pre-class online learning, attendance, classroom performance, after-class assignments, and practical reports, with clear evaluation criteria. Meanwhile, students are encouraged to conduct self-assessment to enhance their principal awareness and self-reflection abilities, promoting fairness, justice, and objectivity in evaluation. Compared with a single method evaluation, this system can comprehensively reflect

students' learning development and knowledge acquisition, which is conducive to timely feedback on teaching design and process, and helps promote students' learning and improve teaching quality.

5. Conclusion

Under the background of intelligent education, reforming the “ecotourism” course based on the OBE concept is an inevitable choice to meet the educational development needs of the new era and to cultivate high-quality ecotourism talents. Integrating intelligent education and the OBE educational concept into the revision of the course syllabus and the setting of teaching objectives, reconstructing online and offline teaching resources, innovating teaching methods, and perfecting the evaluation mechanism can effectively enhance students' practical abilities and innovative thinking, cultivate their comprehensive quality, and train more outstanding professional talents for the development of China's ecotourism industry. However, curriculum reform is a long term and dynamic process that requires continuous exploration and improvement in practice to meet the ever-changing educational and social development needs.

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Research on the Digital Transformation Path of Higher Vocational Education Driven by New-Quality Productive Forces

Yunchao Xia*

Suzhou Vocational Institute of Industrial Technology, Suzhou 215104, Jiangsu, China

**Author to whom correspondence should be addressed.*

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Abstract: Higher vocational colleges are important institutions for cultivating skilled talents. With the development of new-quality productive forces, these colleges need to meet the requirements of digital transformation and improve the effectiveness of talent cultivation. In the process of higher vocational education, it is essential to emphasize teaching innovation and enhance the level of digital teaching. From the perspective of new-quality productive forces, this paper analyzes the new requirements put forward for higher vocational education and proposes specific digital transformation strategies. The purpose is to improve the effectiveness of talent cultivation and accumulate experience for the subsequent digital transformation of higher vocational education.

Keywords: New-quality productive forces; Higher vocational education; Digital transformation

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1. Introduction

The core feature of new-quality productive forces is that scientific and technological innovation plays a leading role, demonstrating characteristics of high efficiency and high quality, which has promoted the transformation of industrial structure and economic development patterns. Higher vocational education is closely linked to economic and social development, and the effectiveness of its talent cultivation is related to industrial upgrading and the development of new-quality productive forces. Against the backdrop of the digital economy era, digital transformation has become an inevitable choice for higher vocational education to enhance its own competitiveness. Driven by new-quality productive forces, higher vocational education needs to break through the limitations of traditional teaching models, strengthen the application of digital technologies such as big data and cloud computing, and promote the innovation of teaching activities. Higher vocational colleges can align with the educational requirements of new-quality productive forces and actively explore digital transformation paths, thereby providing impetus for the development of vocational education.

2. New requirements of new-quality productivity for higher vocational education

2.1. Transformation of talent cultivation goals

New-quality productivity imposes higher demands on talents, and its development is inseparable from skilled talents with innovative and practical capabilities. To meet the needs of the times, higher vocational colleges must adjust their talent cultivation goals, they should not only focus on cultivating students' professional skills but also attach importance to enhancing their comprehensive quality. In the traditional higher vocational education model, teachers prioritized the cultivation of students' single operational skills to meet the requirements of specific positions ^[1]. However, against the backdrop of new-quality productivity, the deepening of industrial integration has led to positions with higher technological content and complexity, placing more in-depth demands on talents. Therefore, teachers need to help students master the application of digital tools, effectively solve practical problems, and develop their lifelong learning abilities. For instance, in the field of intelligent manufacturing, students are not only required to master mechanical processing skills but also need to become proficient in skills such as industrial robot programming to adapt to the needs of intelligent production environments.

2.2. In-depth advancement of industry-education integration

The development of new-quality productivity requires close cooperation between enterprises and higher vocational colleges. As one of the bridges connecting education and industry, higher vocational colleges must emphasize the deepening of industry-education integration ^[2]. In traditional school-enterprise cooperation, enterprises were mainly responsible for providing internships, while schools supplied interns to enterprises. Overall, the depth and breadth of such cooperation were relatively limited. Driven by new-quality productivity, industry-education integration needs to move toward a higher level to achieve collaborative talent cultivation.

Enterprises can actively participate in the talent cultivation activities of higher vocational colleges, jointly formulating talent cultivation goals and curriculum settings, and effectively integrating real enterprise needs into the process. Higher vocational colleges, on the other hand, can strengthen cooperation with enterprises to build corresponding practical training bases and provide technical and talent support for enterprises ^[3]. The deepening of industry-education integration helps connect the education chain with the talent cultivation chain, ultimately cultivating talents who meet the needs of new-quality productivity.

3. Strategies for digital transformation of higher vocational education driven by new-quality productivity

3.1. Innovating the vocational education system

First, develop a digital teaching ecosystem. Educational institutions can strengthen cooperation with governments, enterprises, and other entities to effectively build a digital vocational education ecosystem and enhance the effectiveness of talent cultivation ^[4]. Governments can issue relevant policies to increase support for the digital transformation of education, carry out appropriate guidance activities, and redirect social resources toward vocational education. Enterprises can also actively participate in the development of this ecosystem by providing technical support, employment opportunities, and other resources to higher vocational colleges. Meanwhile, industry associations can play their role as bridges to timely convey industrial information and talent demand. Through the cooperation and exchange among multiple entities, complementary advantages can be realized, resources can be shared, and a favorable ecological environment can be created ^[5].

Governments can establish corresponding special funds to support the development of high-quality digital

platforms and teacher training programs. Enterprises, on the other hand, can transform their own data standards and other resources to enrich teaching materials, thereby facilitating the implementation of teaching activities.

Second, attach importance to the group-based development of vocational education. Digital technology can be used as a carrier to accelerate the group-based development of vocational education, with a focus on realizing the allocation and sharing of resources. Vocational education groups consist of higher vocational colleges, relevant enterprises, and industry associations. By building digital sharing platforms, these groups can effectively achieve the sharing of curriculum resources and practical training resources. Among them, colleges within the group can jointly develop online courses and share educational resources^[6]. Enterprises can provide practical training and technical support to colleges in the group, enabling the efficient use of educational resources. This will enhance the influence and coverage of vocational education and effectively improve the quality of talent cultivation.

3.2. Reforming vocational teaching models

First, attach importance to the implementation of online-offline blended teaching and give full play to the advantages of digital technology. Higher vocational colleges can build high-quality online learning platforms and effectively integrate educational resources, including micro-courses, teaching videos, and more, to provide students with a rich pool of learning materials. Students can also conduct independent learning based on their own learning needs and schedule, use the platform flexibly, and strengthen communication with teachers and peers^[7]. Offline classes can focus on activities such as case analysis and practical operations. Teachers can conduct explanations and tutoring based on the problems students encounter in online learning, realizing the organic integration of online and offline teaching. For example, when teaching content related to CNC machining technology in mechanical majors, students can independently learn relevant basic knowledge and operation procedures through the online platform. During offline practical activities, they can participate in hands-on operations, with teachers providing on-site guidance to help students solve problems encountered in practical operations.

Second, strengthen the application of technologies such as virtual reality (VR) and augmented reality (AR) to create a realistic practical environment. By building virtual training scenarios, students can participate in high-risk and high-cost practical operations, such as power system fault diagnosis in a safe and controlled environment. The application of advanced technologies can effectively transform abstract knowledge into intuitive 3D images, helping students understand and master professional knowledge^[8]. For instance, when teaching medical-related courses, teachers can use VR technology to simulate various clinical nursing scenarios, allowing students to participate in relevant operational training and effectively improving their nursing skills and emergency response capabilities. In the teaching of architecture majors, teachers can also use AR technology to guide students in understanding the internal structure of buildings and construction details, thereby enabling them to gain an in-depth understanding of the construction process.

Third, strengthen the application of big data technology and attach importance to the implementation of personalized learning and precision teaching, so as to effectively meet students' individualized knowledge learning needs^[9]. Through the application of online learning platforms and teaching management systems, students' learning data including learning duration, homework completion status and more can be continuously collected to understand students' knowledge mastery, learning behaviors, and learning status, and conduct corresponding analysis and evaluation. Based on the analysis results, teachers can timely identify students' strengths and weaknesses, and then develop personalized learning plans and tutoring programs^[10]. For

example, for students with a slower learning progress, teachers can recommend basic learning resources and corresponding tutoring courses to enhance the targeting of teaching activities and meet students' knowledge learning needs. For students with strong learning abilities and fast learning progress, teachers can provide extended content to effectively meet their needs for in-depth learning. In addition, big data technology can also provide teaching decision support for teachers, helping them adjust teaching content and methods in a timely manner, and making teaching activities more precise and effective.

3.3. Optimizing the transformation support mechanism

First, attach importance to the construction of digital infrastructure. Higher vocational colleges can increase investment in the construction of relevant facilities to provide hardware support for the digital transformation of education. They can build a stable campus network to achieve full coverage of wireless networks, ensuring the smooth implementation of online teaching and practical training. Additionally, higher vocational colleges can be equipped with corresponding teaching equipment, such as multimedia classrooms and virtual simulation laboratories, to effectively meet the needs of teaching and practical training^[11]. At the same time, they can also construct data centers to ensure the management and storage of teaching and student data. By introducing cloud computing technology and building corresponding data centers, colleges can centrally store and manage teaching resources, thereby improving resource utilization. Second, cultivate a digital teaching workforce. Higher vocational colleges need to attach importance to enhancing teachers' digital literacy. By formulating corresponding teacher training plans and organizing teachers to participate in digital technology training such as online course development and big data analysis, colleges should improve teachers' ability to apply digital technologies^[12]. Furthermore, they can expand the teaching workforce by recruiting professional talents with digital experience to work as teachers. For example, higher vocational colleges can strengthen cooperation with Internet enterprises and invite corporate experts to conduct training on artificial intelligence, big data, and other fields, so as to enhance teachers' digital skills. Third, focus on the optimization of digital management systems. Higher vocational colleges can understand and standardize digital teaching and management work. By formulating corresponding rules and regulations, such as online course construction standards and digital teaching resource management methods, they can ensure the smooth development of digital teaching^[13]. Meanwhile, colleges should monitor and manage the digital teaching process, build a teaching quality supervision system, conduct regular evaluations and inspections of online course quality, and promptly identify and solve problems. Finally, teachers also need to protect students' personal information and learning data, and formulate corresponding management methods to effectively prevent data leakage and abuse.

3.4. Innovating teaching quality evaluation

First, attach importance to the development of a diversified teaching quality evaluation system. Higher vocational colleges should focus on transforming traditional quality evaluation methods and build a diversified quality assessment system. Among this system, evaluation subjects can include teachers, enterprises, and students, who provide objective evaluations of teaching quality from different perspectives^[14]. The evaluation content can cover aspects such as students' mastery of knowledge and skill levels; it should not only focus on students' learning outcomes but also track their learning processes and monitor the improvement of their abilities. When evaluating students' practical abilities, higher vocational colleges can invite enterprise technicians to observe students' internship processes and conduct reasonable evaluations. For the evaluation of students' innovative abilities, teachers can make scientific assessments based on the projects students participate

in and their competition achievements.

Second, strengthen the application of big data technology in teaching quality evaluation. Higher vocational colleges can flexibly use big data technology to collect various types of data throughout the teaching process and conduct corresponding analysis, thereby realizing dynamic teaching evaluation and precise feedback. By analyzing students' teaching-related data, colleges can effectively assess teachers' teaching effectiveness and professional competence, providing sound guidance for teachers' professional development. For example, teachers can analyze students' online learning situations to identify the difficulties students face in knowledge acquisition, and then conduct targeted knowledge explanations and tutoring on relevant content^[15]. Through the implementation of the aforementioned teaching evaluation measures, students can be helped to identify gaps in their own learning, enabling them to conduct targeted knowledge exploration, enhance their professional competitiveness, and better adapt to the demands of new-quality productive forces.

4. Conclusion

In conclusion, the development of new-quality productive forces has brought unprecedented opportunities and challenges to higher vocational education. Digital transformation is an inevitable path for higher vocational education to adapt to the development of the times and enhance its core competitiveness. By implementing strategies such as innovating the vocational education system, reforming the vocational teaching model, optimizing the transformation support mechanism, and innovating teaching quality evaluation, higher vocational education can better meet the demand of new-quality productive forces for high-quality technical and skilled talents, and provide strong talent support for promoting the high-quality development of the economy and society. However, the digital transformation of higher vocational education is a systematic project that requires the joint efforts and long-term investment of multiple subjects such as the government, colleges, and enterprises. Therefore, it is necessary to continuously strengthen research and practical exploration, constantly improve the path of digital transformation, and promote higher vocational education to achieve higher-quality development driven by new-quality productive forces.

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Research on Optimization Strategies for Integrating “Mass Entrepreneurship and Innovation” Education into Computer-Related Professional Courses in Vocational Schools

Jingxuan Wu*

School of Information, Xinjiang Agricultural Vocational and Technical University, Changji 831100, Xinjiang, China

**Author to whom correspondence should be addressed.*

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Abstract: With the in-depth advancement of vocational education reform, the concept of “Mass Entrepreneurship and Innovation” has emerged at the historic moment. Integrating “Mass Entrepreneurship and Innovation” education into the teaching of computer-related professional courses in vocational schools is conducive to cultivating high-quality applied talents. Based on this, this paper deeply analyzes the connotation and characteristics of “Mass Entrepreneurship and Innovation” education, and examines the current status and existing problems of integrating such education into computer-related professional courses. Furthermore, it proposes optimization strategies from aspects including the formulation of course objectives, the reconstruction of teaching content, the innovation of teaching methods, the development of teaching staff, and the construction of practical platforms. The purpose is to enhance students’ innovative thinking, entrepreneurial capabilities, and professional skills, and to provide professional talents with “Mass Entrepreneurship and Innovation” literacy for the development of the computer industry.

Keywords: “Mass Entrepreneurship and Innovation” education; Vocational schools; Computer-related majors; Curriculum optimization; Strategies

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1. Introduction

In response to the rapid progress of science and technology, the need for talents specializing in information technology has risen significantly in recent years. The teaching of computer majors in vocational schools undertakes the important responsibility of cultivating high-skilled and high-quality talents for society. In the context of “Mass Entrepreneurship and Innovation”, teachers should not only focus on cultivating students’ professional quality and abilities but also develop their innovation and entrepreneurship capabilities. However, at the current stage, computer majors in vocational schools in China have not attached sufficient importance

to innovation and entrepreneurship teaching. This neglect of innovation and entrepreneurship education is not conducive to students' all-round development.

2. Overview of “Innovation and Entrepreneurship” education

“Innovation and Entrepreneurship” education aims to cultivate talents with innovation and entrepreneurship literacy as well as an innovative spirit. Its content includes the cultivation of entrepreneurial awareness, entrepreneurial spirit, and entrepreneurial capabilities, which requires educators to carry out education in a hierarchical and phased manner. The value of “Innovation and Entrepreneurship” education lies in fostering talents with an innovative spirit; it is not merely about conducting entrepreneurial course teaching and skill training, or providing students with practical learning opportunities. The implementation of “Innovation and Entrepreneurship” education helps students engage in independent entrepreneurship in their future careers, exert their personal innovative practical abilities, and contribute to promoting economic development and social progress^[1].

“Innovation and Entrepreneurship” education is not limited to innovation and entrepreneurship education in a specific discipline or field; it covers various disciplinary fields and requires students to possess multi-faceted knowledge and skills. This also means that “Innovation and Entrepreneurship” education needs to break the limitations of disciplines and teaching, integrate knowledge and skills from different fields, and cultivate students' comprehensive quality capabilities and innovative practical abilities. “Innovation and Entrepreneurship” education not only requires the teaching of theoretical knowledge, but more importantly, enables students to develop practical application capabilities and improve their own innovative literacy through practical means. This requires the full integration of theory and practice in educational work, allowing students to participate in practical exploration so as to achieve development and progress. “Innovation and Entrepreneurship” education is a systematic process that needs to comprehensively cultivate students' quality and capabilities from the perspectives of cognition, skills, and other aspects^[2].

3. Current situation of integrating “Innovation and Entrepreneurship” education into computer-related professional courses in vocational schools

In China's education field, innovation and entrepreneurship education has developed against the background of the transformation of educational forms. However, at present, the integration of innovation and entrepreneurship education with China's overall education system still needs to be improved, which requires strengthening research in this area to identify existing problems.

3.1. Lack of the concept of cultivating innovation and entrepreneurship capabilities

From the current situation of computer professional teaching in higher vocational colleges in China, these colleges do not attach importance to the cultivation of students' innovation and entrepreneurship capabilities, have a shallow understanding of the concept of cultivating such capabilities, and fail to establish a correct concept for cultivating innovation and entrepreneurship capabilities^[3]. Traditional teaching models are still adopted in educational work, which makes it difficult for education to achieve good results. There is a certain deviation between educational work and the talent needs of the industry, which is also not conducive to students' future employment and development.

3.2. Low effectiveness of professional teaching quality management

Under the traditional teaching model, computer professional teaching in higher vocational colleges emphasizes theory over practice. In the process of talent cultivation, there is a problem of imperfect teaching quality management systems. Greater emphasis is placed on the systematic implementation of teaching content, which cannot be consistent with the innovative concepts of the times and is not conducive to in-depth analysis of social phenomena, thus hindering students' development. Moreover, the content of computer courses in higher vocational colleges is relatively outdated, and teaching focuses more on the explanation of theoretical knowledge with insufficient practicality, which also makes it difficult to improve the effectiveness of teaching^[4]. In addition, teaching quality management faces problems such as difficulty in designing evaluation indicators for management effectiveness and difficulty in conducting objective evaluations. Higher vocational colleges do not conduct overall supervision and evaluation of the computer market, which also leads to inconsistency between the vocational cultivation of computer students in higher vocational colleges and the development needs of the market.

3.3. Weak teaching staff in computer majors of higher vocational colleges

Due to the relatively fast update speed of computer technology, many computers professional teachers in higher vocational colleges are relatively young at this stage, and their teaching experience is insufficient. At the same time, many computers professional teachers in higher vocational colleges only receive short-term training before taking up their posts and have not received systematic and comprehensive learning in computer science. This also causes major problems in teaching work, leading to deviations in the concept, positioning, and methods of talent cultivation. Some teachers in higher vocational colleges have high academic qualifications and professional titles, and their teaching and research capabilities are relatively strong, but they are insufficient in innovation and entrepreneurship education capabilities and lack the pioneering ability in the computer industry^[5].

3.4. Insufficient atmosphere for innovation and entrepreneurship

At this stage in China, a sound innovation and entrepreneurship environment has not been built, which limits the cultivation of innovation and entrepreneurship capabilities in higher vocational colleges. Therefore, it is difficult for computer majors in higher vocational colleges to attach importance to innovation and entrepreneurship education in their educational work, which is also not conducive to students' development^[6]. In addition, entrepreneurship requires certain resources and funds as external support, but most graduates find it difficult to obtain sufficient financial resources, which is not conducive to the development of students' initial entrepreneurial work.

4. Measures for integrating “Mass Entrepreneurship and Innovation” education into computer-related professional courses in vocational schools

4.1. Grasp the market pulse to optimize professional orientation

With the rapid development of information technology, the computer industry has achieved upgrading and iteration, and the requirements for talents in the computer employment market are constantly changing. Therefore, if higher vocational colleges want to transform their talent training models, they need to keep up with market changes, adapt to the development needs of the industry in the new era, and properly position the development of computer majors. At this stage, the computer industry market focuses more on cultivating

talents with strong practical operation capabilities and high professionalism. However, in the current teaching process of computer majors in higher vocational colleges, it is difficult to fully integrate theory and practice. For this reason, higher vocational colleges should establish a more complete professional curriculum system, optimize computer theoretical knowledge, and thereby improve students' practical application capabilities. Moreover, adding relevant career guidance courses to the professional curriculum also helps students clarify their future career directions, so as to better solve the problems they encounter in the learning process^[7,8].

4.2. Attach importance to the construction of innovation and entrepreneurship education concepts

Higher vocational colleges should clarify the market positioning of computer majors according to the development of the industry, constantly adjust and transform the traditional educational ideas and concepts of computer majors, and further enhance students' sense of innovation and innovation and entrepreneurship capabilities. In order to improve teachers' recognition and understanding of "Mass Entrepreneurship and Innovation" education, colleges can organize teachers to actively participate in various training and learning activities, so as to deeply understand the basic concepts, purposes, significances and methods of "Mass Entrepreneurship and Innovation" education. At the same time, schools should also encourage teachers to understand the latest research results by participating in academic conferences, seminars and other methods, so as to continuously improve their own level of educational concepts. Schools can formulate a more complete innovation and entrepreneurship education system to ensure the effective penetration of "Mass Entrepreneurship and Innovation" education concepts. For students, it is particularly crucial to improve their awareness of the implementation of "Mass Entrepreneurship and Innovation" education^[9,10]. To this end, teachers can introduce cases of school graduates to help students understand and recognize the important value of "Mass Entrepreneurship and Innovation" education, thereby stimulating their enthusiasm for entrepreneurship. Entrepreneurs and investors can be invited to share their entrepreneurial experiences with students, allowing students to understand the importance of entrepreneurship. At the same time, students can be organized to participate in various innovation and entrepreneurship projects, develop programs with market prospects, and enable students to recognize the value of "Mass Entrepreneurship and Innovation" education in practical operations^[11].

4.3. Build a high-quality integrated teaching staff

In the process of computer professional teaching, strengthening educational reform and integrating the "Mass Entrepreneurship and Innovation" education model not only requires the construction of a more complete curriculum education system, but also needs to build a more reasonable teaching staff system. The teaching staff should have a strong sense of innovation and entrepreneurial thinking, possess certain practical application capabilities, and be able to provide overall and comprehensive guidance to students. Therefore, this requires vocational colleges to take a series of measures to build an integrated teaching staff^[12]. First of all, conduct innovation and entrepreneurship education and training for all teachers, organize teachers to participate in relevant seminars and training courses, encourage teachers to conduct on-site inspections in enterprises, and actively invite entrepreneurs with entrepreneurial experience to give lectures in schools. A series of these measures help teachers strengthen their own learning awareness and form a good ability to guide innovation and entrepreneurship. Secondly, schools can hire entrepreneurs and investors with rich entrepreneurial experience as part-time tutors. These tutors often have more abundant teaching and guidance experience and

can provide more accurate and comprehensive guidance to students. At the same time, they can tell students about their experiences in the entrepreneurial process, so that students can strengthen their understanding, master entrepreneurial skills, and further deeply understand the important significance of innovation and entrepreneurship^[13]. Such practical activities also help teachers in schools to deeply understand the process of innovation and entrepreneurship, improve their own professional capabilities, and better carry out teaching work.

4.4. Strengthening the construction of an educational environment for innovation and entrepreneurship

Funding is a prerequisite guarantee for promoting students' entrepreneurship. Therefore, the government should provide more abundant resources and funds as support, and strengthen the follow-up work of entrepreneurship training. Higher vocational colleges should also create a favorable cultural environment for innovation and entrepreneurship, organize students to actively participate in entrepreneurship competitions and knowledge contests, so as to improve students' comprehensive quality and abilities, accumulate more experience for their entrepreneurial endeavors, and hold innovation and entrepreneurship lectures to further stimulate students' enthusiasm for entrepreneurship. At this stage, college clubs feature a diversified form; thus, colleges should establish entrepreneurial clubs and organize club activities to cultivate students' innovation and entrepreneurship capabilities. Schools can strengthen cooperation with schools and enterprises in other regions, or actively participate in provincial and national special activities related to innovation and entrepreneurship, providing students with more high-level practical learning opportunities. This series of activities also helps students enhance their own innovation and entrepreneurship capabilities, gain more support and recognition, and promote their personal development^[14].

4.5. Enhancing the construction of computer major curriculum system

In computer curriculum teaching, the focus should not be limited to knowledge instruction; instead, it is necessary to supplement content related to innovation and entrepreneurship. This ensures the effective integration of professional teaching content and innovation and entrepreneurship knowledge, further reflecting the value of innovation and entrepreneurship education. Among various approaches, classroom teaching serves as the main method for talent cultivation. In computer professional teaching, teachers should play their leading role and further highlight the dominant position of students. Schools should actively offer courses related to innovation and entrepreneurship to help students master the basic knowledge and skills in the field of innovation and entrepreneurship. The offering of these courses also helps students fully understand the concepts related to entrepreneurship and give play to their own creativity and innovative thinking. Teachers should also compile corresponding teaching materials and lesson plans, enabling them to better integrate innovation and entrepreneurship education into daily teaching and helping students fully understand and master the knowledge and skills in the field of innovation and entrepreneurship. In addition, schools should build innovation and entrepreneurship laboratories to provide students with more opportunities for practical participation, so that students can consolidate the knowledge they have learned through practical means. Laboratories should focus on practicality and innovation, allowing students to complete practical operations and project practices, thereby improving their practical application capabilities. At the same time, it is also necessary to pay attention to the close integration between computer courses and the content of other disciplines, and build an interdisciplinary teaching system to further enhance students' practical application capabilities^[15]. During the teaching process,

the adoption of heuristic teaching also helps students achieve innovative development of thinking, enabling them to fully recognize different fields of their own development and thus not be limited to a single aspect. For example, computer majors can establish cooperative relationships with computer enterprises, introduce corresponding practical projects, and let students design relevant websites for enterprises or create computer sales platforms. Another example is that schools can set up a “Internet + industrial development” model in curriculum teaching, encouraging students to give play to their professional advantages, further explore new methods of professional teaching, and change the specific direction of employment.

5. Conclusion

To sum up, integrating “innovation and entrepreneurship” education into the teaching of computer majors in higher vocational colleges is conducive to the development of students’ innovation and entrepreneurship capabilities and enhances their social competitiveness. In practical teaching, teachers can take a series of measures to improve the effectiveness of innovation and entrepreneurship education, such as grasping the pulse of the market to optimize professional positioning, attaching importance to the construction of innovation and entrepreneurship education concepts, building a high-quality integrated teaching staff, strengthening the construction of an educational environment for innovation and entrepreneurship, and enhancing the construction of the computer major curriculum system.

Disclosure statement

The author declares no conflict of interest.

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Research on the Theoretical Innovation and Practical Path of Integrity Education in Colleges and Universities in the New Era

Tian Xiong

Hainan Vocational University of Science and Technology, Haikou 571126, Hainan, China

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Abstract: Integrity education is an important part of the implementation of the fundamental task of cultivating moral integrity in colleges and universities, and it is also an intrinsic requirement for cultivating excellent teaching and learning styles. This paper is based on the connotation characteristics of integrity education in colleges and universities in the new era and the value of the times, and systematically analyses the current integrity education in colleges and universities there are imperfect system mechanisms, collaborative parenting there are short boards, a single form of practice and digital empowerment of insufficient and other realities of the dilemma, and from the moral and ethical teachers as the core of the construction of the construction of the system as a safeguard , to collaborative parenting as a grasp and digital technology as a means of the four dimensions of the proposed targeted practice paths In order to provide theoretical reference and practical reference for the high-quality development of integrity education in colleges and universities.

Keywords: Integrity education; Colleges and universities; Teacher ethics; Campus culture; Collaborative parenting

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1. Introduction

As an important position for cultivating talents, colleges and universities shoulder the noble mission of cultivating high-quality talents. The level of integrity education is directly related to the shaping of correct values of young students and the healthy development of education, and integrating integrity education into the construction of colleges and universities can give full play to its educational function. At present, the rapid development of society and the progress of information technology has brought new challenges, the campus inside and outside the bad atmosphere and multicultural fusion also formed an impact on the values of college students. At present, some colleges and universities still have problems such as insufficient coverage of integrity education, weak effectiveness, and disconnection with professional education. In this context, in-depth study of the theoretical innovation and practical path of integrity education in colleges and universities in the new era has important theoretical value and practical significance. This paper is based on the characteristics of integrity culture in the

new era, combined with the typical cases of integrity education in colleges and universities, analyzing the connotation of characteristics, the reality of the dilemma and the practical path, and trying to build a set of scientific and effective, operational integrity education system, to provide theoretical support for integrity education in colleges and universities and practical reference.

2. Connotation characteristics and contemporary value of integrity education

2.1. Connotation characteristics of integrity education in colleges and universities

Integrity education is an important part of college education, and in the context of the current educational reform and social development, colleges and universities should strengthen the education of integrity culture and cultivate students to establish moral consciousness and social responsibility. Integrity is an intrinsic quality and value, with the following connotative features.

Firstly, it is innovative. Integrity culture is rooted in the excellent traditional Chinese culture, “integrity culture” concept first originated from the great poet of the Warring States period, Qu Yuan’s “Chu Rhetoric: Invocation of the Soul”: “I’m young and clear to be honest and clean, and the body serves the righteousness and not foam.” Wang Yi, a famous scholar of the Eastern Han Dynasty, commented in “Chu Rhetoric Chapters and Sentences”, “Not to be said to be clean, not to be polluted is said to be clean”^[1]. That is, it is clean. Zhu Xi of the Southern Song Dynasty interpreted in his “Chu Rhetoric Collection Note”: “Lian, its line of defense. Clean, its body is not dirty”, the connotation of integrity into moral and behavioral norms^[2].

Secondly, it is moral. Integrity education as an important carrier of moral education, not only to teach knowledge, but also carries the mission of cultivating students’ noble character, sound personality, through the promotion of honest and upright values, can shape students’ character and promote the overall development of individuals.

Finally, it is normative. Schools should guide teachers and students to adhere to the bottom line of professional ethics through the education of clean and honest culture, and under the education of clean and honest culture, through the cultivation of noble moral qualities of young students, so that students can consciously recognize the virtues of honesty and integrity, and set up the moral code of conscientious compliance with laws and regulations.

2.2. The value of the times of integrity education in colleges and universities

To carry out integrity education in the new era, it is necessary to establish a sound system, guide teachers and students to establish a sense of moral norms, effectively reduce the occurrence of irregularities, and constantly improve the management level of the school.

First of all, integrity education is an effective way to enhance the concept of the rule of law for teachers and students. Noble teacher ethics and teaching style will inspire teachers to be more committed to teaching, forming a positive teaching atmosphere, which can promote trust and cooperation between teachers and students, and enhance moral awareness and the concept of the rule of law. For example, by carrying out various forms of integrity education and anti-corruption activities, teachers and students will be aware of the dangers of corruption, so as to enhance the awareness of compliance with the law.

Secondly, integrity education is an important guarantee for shaping students’ good and noble character. By carrying out integrity education, we can cultivate young people of the new era with a sense of integrity, moral character and social responsibility, and lay a solid moral foundation for them to become useful talents in the society in the future.

Finally, integrity education is a necessary measure to promote integrity risk prevention and control in colleges and universities. Colleges and universities need to take the initiative to introduce advanced technical means such as prevention and control of risk management in order to enhance the predictability and effectiveness of anti-corruption and integrity promotion, and to take practical preventive and control measures for the risk points of key positions.

3. The reality of the dilemma of integrity education in colleges and universities

3.1. Institutional mechanisms are not perfect

With the rapid development of higher education, some institutions have established a systematic institutional mechanism. On the one hand, due to the management's insufficient attention to the systems, the lack of implementation, especially in the key areas related to the construction and implementation of the rules and regulations of the weak links, affecting the effective implementation of the integrity system. On the other hand, the construction work of regulations in some institutions still needs to be improved. For example, the supervision mechanism for the construction of teacher ethics in colleges and universities is not perfect, the reward and punishment mechanism is not sound, the teachers who violate the provisions of teacher ethics are not dealt with effectively, and there is a lack of sufficient motivation for the growth and development of teachers.

3.2. There is a short board of collaborative education

Integrity education in colleges and universities needs to be all-embracing and all-process education to ensure that integrity education is comprehensively and deeply promoted in colleges and universities. At present, some colleges and universities integrity education and school teaching, research, management and other central work there is a disconnect phenomenon, resulting in integrity education in the form of formalism. Due to the lack of effective articulation of collaborative education, resulting in integrity education failed to effectively integrate with the depth of the work of the school, especially in the enrolment, examination, evaluation of awards and prizes, the use of funds and other aspects of the lack of systematic, collaborative education is not enough to achieve results, resulting in poor results of integrity education.

3.3. Single form of practice

At the practical level, integrity education should not only teach theoretical knowledge, but also strengthen practical teaching. Some institutions to carry out integrity education is detached from the actual life, focusing on theoretical teaching and lack of case study. Some institutions are still stuck in the integrity education activities themed on disciplinary studies, speeches, debates, etc., with insufficient consideration of students' individuality, resulting in low motivation for students to participate in integrity education and a lack of ability to dig deeper and solve practical problems.

3.4. Insufficient digital empowerment

With the rapid development of digital technology and the popularity of new media, the traditional mode of integrity education is no longer adapted to the needs of today's students, who are more inclined to obtain information through the Internet and other channels. At present, some colleges and universities are not innovative enough in the way of integrity education, and they can't effectively use digital means to carry out education. Colleges and universities can use watching videos, participating in online discussions, making clean microfilms

and other ways to improve student participation and enhance the interactivity and fun of education.

4. Exploration of the practical path of integrity education in colleges and universities

4.1. Teacher moral construction as the core, build a firm foundation of clean teaching

Integrity education is effectively integrated into the construction of teachers' morality, which plays an important role in improving the moral quality and professionalism of teachers and establishing a good teaching and learning style. On the one hand, actively carry out special training activities for teachers' morality. Creating a clean and honest nurturing team is an important initiative to promote the construction of clean schools. Through the organization of teachers to participate in teaching and research, teaching staff study classes and other special training, and solidly carry out the education activities of teacher morality, not only helps to establish a good image of teacher morality, but also influences and educates the students through the noble personality and solid academic knowledge of teachers. For the community to cultivate more talents with high moral character and morality. On the other hand, the teacher ethics assessment as an important basis for teacher appointment, promotion, reward and punishment. Strictly implement the "one-vote veto system" for teachers' morality, and improve teachers' professional ethics and character cultivation by carrying out activities of students' evaluation of teaching and parents' evaluation of schools; and further enhance the teachers' sense of integrity by setting up individual teachers' morality files and signing the commitment letter of teachers' morality and ethics.

4.2. Take system construction as a guarantee, standardize the power operation mechanism

Colleges and universities should establish a sound internal management system to ensure the institutionalization and standardization of the education of clean culture.

First of all, it is necessary to establish and improve the institutional mechanism of integrity education. For example, the integrity risk prevention and control mechanism and the supervision system of teachers' morality and ethics. In particular, it is necessary to strengthen the supervision and constraints between the leadership in key areas, and the decision-making on major matters should adhere to the democratic centralism system for collective discussion and deliberation, so as to make more scientific decisions. For example, to strengthen the supervision of school finance, enrolment, teacher appointment and other key positions and important areas, to prevent the occurrence of corrupt behavior.

Secondly, strengthen disciplinary education and organizational concepts. Strengthen ideological cohesion through regular activities on the theme of teacher ethics and morality; establish a sound performance appraisal mechanism for teaching staff, and conduct regular inspections and appraisals on teacher ethics, teaching, scientific research, etc., to ensure that teachers consciously abide by national laws and regulations as well as relevant documents and regulations of the school, and establish a good image of teacher ethics and morality.

Finally, the establishment of student self-discipline committee, to strengthen the supervision and constraints on the construction of class cleanliness, through extensive listening to the suggestions of teachers and students, and orderly expanding the participation of teachers and students in politics, to ensure the effective implementation of various construction systems and implementation programs in the class.

4.3. Taking collaborative education as the grasping hand, building a pattern of full participation

Integrity education is a systematic project, and it is necessary to fully tap the integrity resources of the society

and the family to form a strong synergy of society, family and school.

First of all, the school and society to establish a cooperative relationship. Make full use of social resources to broaden the practice of clean education activities, by watching educational films on anti-corruption themes, clean calligraphy and painting exhibition, to participate in green social activities, etc., in the real social environment to feel the charm of the clean culture, enhance the conscientiousness of the clean and self-discipline and the power of action.

Secondly, schools and families to establish a communication mechanism. To adhere to the systematic concept, the construction of clean schools and clean families combined, through class meetings, thematic educational activities and other forms of feedback to parents to carry out clean education in schools, deepen the understanding of families and students on clean culture, and promote the construction of clean schools to enhance the quality and effectiveness.

Finally, to promote communication and interaction between teachers and students. Integrity education is carried through in the daily management of school teaching, strengthening the synergy of various departments within the school, promoting teachers and students to supervise each other, learn from each other, and create a clean atmosphere together.

4.4. Digital technology as a means to enhance the effectiveness of human education

In integrity education, colleges and universities should make good use of the Internet, big data and other emerging technologies to continuously improve the ability of integrity risk prevention and control.

On the one hand, it is necessary to play the leading role of teachers in integrity education, explore the “intelligence + integrity” teaching mode by improving the digital technology literacy of teachers, make full use of modern technology means, such as network platforms, new media, etc., and innovate to carry out a variety of forms of integrity education activities with rich content, so as to expand the coverage and influence of integrity education.

On the other hand, it is necessary to combine the collection, storage and analysis functions of big data technology with the prevention and control of integrity risks in colleges and universities, use big data for timely and real-time monitoring, scientific data analysis, and constantly upgrade the big data supervision technology to further improve the supervision and governance system of institutions.

5. Conclusion

Integrity education in colleges and universities is a systematic project, which is related to the healthy growth of young students and the long-term development of education. In the future, colleges and universities should further combine the characteristics of the times and the characteristics of students, explore the “intelligence + integrity” teaching mode, promote the deep integration of integrity education and digital technology, cultivate high-quality talents with both professionalism and integrity, and contribute to the construction of a clean China and the rejuvenation of the nation.

Disclosure statement

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Research and Practice on the Progressive Training Model of Meizhou Hakka Cuisine Cooking Talents Based on the Integration of Industry and Education and Work–Study Alternation

Ganhong Chen, Yong Liu, Pingping Luo, Weirun Liang*

Guangdong Meizhou Vocational and Technical College, Meizhou 514000, Guangdong, China

**Author to whom correspondence should be addressed.*

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Abstract: The development of Meizhou Hakka cuisine relies on the role of professional cooking talents. Higher vocational colleges serve as the platform for cultivating cooking talents. Among various training models, the implementation of the progressive talent training model featuring the integration of industry and education and work-study alternation is conducive to carrying out talent cultivation activities, improving the effectiveness of professional talent development, and effectively meeting the needs of market development. From the perspective of Meizhou Hakka cuisine cooking talents, this paper analyzes the problems existing in the implementation of the industry-education integration and work-study alternation model, and puts forward specific practical strategies for talent cultivation. The purpose is to enhance the training effect of Hakka cuisine cooking talents and provide reference for the subsequent optimization of professional teaching.

Keywords: Integration of industry and education; Work-study alternation; Meizhou Hakka cuisine; Progressive talent training

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1. Introduction

Meizhou Hakka cuisine is an important part of Hakka culture, embodying the unique dietary and cultural habits of the Hakka people. With the development of the catering industry, people's demand for food culture is constantly increasing, bringing new development opportunities to Hakka cuisine. However, the talent cultivation of Meizhou Hakka cuisine cooking is facing many challenges, making it difficult to meet the development needs of the industry. The integration of industry and education and work-study alternation are helpful to improve talent cultivation activities, enhance the effectiveness of Meizhou Hakka cuisine cooking professional education, exert positive application value, promote the inheritance and innovation of Hakka food culture, and

thus achieve good results in talent cultivation.

2. Problems existing in the mode of industry-education integration and work-study alternation in higher vocational colleges

2.1. Poor connection in the curriculum system

From the perspective of cultivating Meizhou Hakka cuisine cooking talents, the curriculum design for secondary and higher vocational education lacks systematic planning, showing problems such as duplicated content and unclear hierarchical differentiation. In both secondary vocational and higher vocational stages, the knowledge and skills training in Hakka cuisine cooking courses lacks a progressive relationship, which easily leads to problems like repeated learning and knowledge gaps among students ^[1]. For example, basic cooking methods are covered in both secondary and higher vocational courses, but the differences in the depth and breadth of teaching are not obvious. This not only causes a waste of resources but also fails to meet the needs of students' growth, hindering the step-by-step improvement of their skills. At the same time, the post-vocational training lacks connection with professional courses and fails to align with industry development and job requirements, resulting in students being unable to receive forward-looking technical training.

2.2. Lack of connection between culture and professional programs

In the cultivation of Hakka cuisine cooking talents, higher vocational colleges have not conducted in-depth exploration of Hakka food culture. In teaching practice, emphasis is usually placed on the teaching of cooking skills, while the integration of the spiritual connotation of traditional Hakka food culture is neglected. Although students can master certain cooking techniques, it is difficult for them to understand the connotations of frugality and craftsmanship embodied in Hakka cuisine, leading to a lack of inheritance of cultural connotations ^[2]. Additionally, due to the singularity of cultural inheritance forms, it is difficult to effectively integrate Hakka culture with professional teaching. This leads to students' lack of enthusiasm for learning Hakka culture and easily gives rise to the problem of discontinuity in the inheritance of Hakka food culture.

2.3. Poor evaluation effect of work-study alternation

In the talent cultivation of Hakka cuisine cooking in higher vocational colleges, the evaluation of work-study alternation plays an important role. However, from the perspective of actual classroom teaching, the current evaluation focuses on students' work performance and enterprise feedback, with the problem of a single evaluation subject. It is difficult to conduct a comprehensive evaluation of students in terms of their learning process and professional quality ^[3]. At the same time, the setting of evaluation criteria lacks scientific rationality, as it overemphasizes results while ignoring process-oriented evaluation, making it difficult to accurately and effectively reflect students' growth.

2.4. Insufficient depth of integration between colleges and enterprises

With the development of the new era, people's food culture has undergone significant changes. Meizhou Hakka cuisine, as a local cuisine, has a relatively limited influence. To achieve development and expansion, colleges need to attach importance to talent cultivation, and enterprises should promptly convey market demands ^[4]. Currently, catering enterprises rarely participate in the formulation of talent cultivation plans in higher vocational colleges, and there is a lack of effective interaction regarding teaching plans and content.

3. Integration of production and education, practical strategies for cultivating Meizhou Hakka cuisine cooking talents under the work-study alternation model

3.1. Improve the curriculum connection mechanism and enhance professional skills

Higher vocational colleges (HVCs) need to take CBE (Competency-Based Education) as the core, break down the curriculum barriers between secondary vocational education and higher vocational education, and reconstruct the curriculum system in accordance with the stepped principle. In the secondary vocational education stage, the teaching of Meizhou Hakka cuisine cooking should focus on improving students' basic competencies, and actively offer courses such as Hot Dish Preparation and Food Carving. Practical training helps students master Hakka cuisine cooking techniques and properly handle ingredients, laying a solid foundation for their subsequent knowledge learning. For example, when teaching the content of hot dish preparation, students can systematically learn and understand the preparation method of Meicai Kourou (Braised Pork with Preserved Vegetables), a traditional Hakka hot dish. They will master skills in ingredient selection, processing, and cooking, and conduct comprehensive practical operations.

HVCs should attach importance to enhancing students' management and innovation capabilities, and effectively improve their professional skills through courses such as banquet design and nutritional menu planning.

For the construction of the Banquet Design course, students are required to proficiently master dish matching methods, understand banquet theme planning and services, with a focus on cultivating their comprehensive management and innovation qualities^[5]. The Nutritional Menu Planning course helps students master nutritional knowledge proficiently, enabling them to match Hakka cuisine banquets according to the needs of different customers.

In addition, during the post-employment phase, attention should be paid to the frontiers of Hakka cuisine cooking technology, and various courses should be actively offered, such as Hakka Banquet Cuisine Seminar and Innovation of Classic Hakka Dishes. HVCs can invite experts and backbone practitioners to help students grasp the demand of Meizhou's food market and the development trend of Hakka cuisine cooking. Students are encouraged to participate in the innovation of Hakka cuisine to effectively improve the quality of Hakka cuisine and enhance its market competitiveness. For instance, practitioners who understand traditional Hakka classic dishes can carry out reasonable improvement and innovation, this not only preserves the traditional flavor, but also integrates advanced cooking technology and health concepts, effectively meeting the taste needs of consumers in the new era.

3.2. Give play to the role of Hakka culture and realize cultural empowerment

First, attach importance to the infiltration of the spiritual connotation of Hakka cuisine and adjust teaching activities at various stages. Starting from the secondary vocational education stage, the spiritual connotation of Hakka cuisine can be integrated, textbook compilation can be adjusted, and professional teaching activities can be improved. Schools can compile school-based teaching materials that introduce the preparation of Hakka cuisine and explain in detail the concepts of frugality and craftsmanship embodied in various dishes. For example, when teaching the preparation of Niang Doufu (Stuffed Tofu), teachers should not only explain its preparation methods, but also introduce the origin of the dish: during the period of material scarcity, the Hakka people made full use of tofu and minced meat to create this delicious dish, which reflects their wisdom of frugality^[6]. Teachers can guide students to select fresh ingredients, embodying the concept of natural diet. Based on this, teachers can use teaching methods such as in-class lectures and case studies to help students gain an intuitive understanding of Hakka dietary culture and enhance their sense of identity and pride in it. In

the teaching of HVCs, the content of Hakka banquet design should be taught, with Hakka cultural elements integrated to adjust the banquet design ^[7]. Teachers can focus on highlighting Hakka cultural characteristics from the perspectives of banquet conception and tableware selection. For example, a banquet simulation activity can be organized with the theme of “Hakka New Year Flavors”, and the naming of dishes can also reflect Hakka cultural characteristics. The implementation of such teaching practices allows students to experience Hakka culture and effectively improve their cultural literacy.

Second, build a hub for “Master Studios”. Higher vocational colleges can take Chen Gangwen’s National-Level Studio as the core to integrate a variety of resources, including those from enterprises and industry associations, and create a favorable education environment. The studio can undertake tasks such as Hakka cuisine cooking and professional talent cultivation. On one hand, master studios can carry out regular cooking skill training and exchanges, and invite industry masters to share their exquisite cooking techniques and experience ^[8]. On the other hand, master studios can communicate with enterprises to conduct research and development of classic Hakka dishes. They can improve and innovate dishes based on market and consumer demands, developing dishes with market competitiveness ^[9]. At the same time, master studios should actively engage in the exploration and organization of Hakka dietary culture, integrate Hakka dietary culture into dish research and development and talent cultivation activities, and promote the integration of cultural inheritance and industrial development.

3.3. Optimize the work-study alternation evaluation system and improve practical talent cultivation

First, attach importance to the diversification of evaluation subjects. Higher vocational colleges can develop evaluation subjects, involving teachers, students, and corporate mentors, among others. Among these subjects, teachers can conduct effective evaluation activities based on their expertise and skills in Meizhou Hakka cuisine. They should pay attention to students’ individual situations and gain an understanding of their academic performance in class and practical performance ^[10]. Corporate mentors need to focus on areas such as students’ practical abilities, professional qualities, and work attitudes when carrying out evaluations. They should understand students’ performance during internships at enterprises, and provide objective evaluation opinions based on their work performance. Students can engage in self-evaluation and peer evaluation activities: self-evaluation encourages students to reflect on themselves and actively participate in the learning of culinary knowledge, enabling them to summarize the gains and shortcomings from their work-study alternation; peer evaluation allows them to learn from others’ strengths and clearly identify their own problems. For example, after students complete their internships in catering enterprises, teachers, corporate mentors, and the students themselves can jointly assess the students’ performance, conduct a scientific evaluation by synthesizing their various qualities, and formulate a comprehensive evaluation report.

Second, attach importance to the improvement of multi-dimensional evaluation criteria. Higher vocational colleges should align with the teaching situation of Hakka cuisine cooking and evaluate students in aspects such as their learning attitude, participation level, and knowledge acquisition throughout the professional learning process. For the improvement of vocational skills, it is necessary to focus on assessing students’ abilities, and identify their capabilities in areas like cooking and management demonstrated during the work-study alternation phase. Regarding culinary professional literacy, teachers need to evaluate students’ competencies, such as teamwork and communication skills. In terms of work outcomes, teachers can conduct scientific and reasonable evaluations by considering students’ individual circumstances, and examining aspects like their

completion of work tasks and innovative achievements ^[11]. For example, for students who participate in the preparation of corporate banquets, evaluations can focus on the quality of the dishes they prepare. Additionally, it is necessary to assess their role in teamwork and whether they meet customer needs. By implementing multi-angle evaluation criteria, the growth and progress of students during the work-study alternation phase can be comprehensively and accurately reflected.

Third, actively improve the evaluation and feedback mechanism. Higher vocational colleges should attach importance to the development of this mechanism, provide timely feedback on evaluation results, and facilitate adjustments for students, teachers, and enterprises. Regarding feedback on student evaluations, teachers and corporate mentors can communicate with students, conduct in-depth analysis of the evaluation results, identify potential problems, and put forward targeted improvement suggestions ^[12]. Meanwhile, teachers and enterprises need to improve teaching and practical training based on evaluation feedback, adjust teaching content and methods, and make teaching more targeted. For example, through evaluation activities, teachers can identify students' shortcomings in the innovation of banquet dishes ^[13]. Furthermore, in subsequent professional teaching, relevant courses and practical sessions can be appropriately increased; enterprises can provide students with more opportunities for dish innovation, thereby supporting their all-round development.

3.4. Build a “dual-qualified” teacher team to guarantee teaching activities

HVCs can encourage teachers to participate in practical training in Meizhou-based Hakka cuisine catering enterprises. During their placement in these enterprises, teachers can engage in work such as dish cooking and enterprise management. Through enterprise practice, professional teachers can gain a clear understanding of industry trends, learn advanced Hakka cuisine cooking techniques, and enrich their practical experience, laying a solid foundation for subsequent professional practical teaching ^[14]. For example, HVCs can cooperate with local catering enterprises in Meizhou, set regular intervals, and arrange for teachers to participate in practical training. During the practice period, teachers can be involved in enterprise operations and dish research and development, accumulate more experience, and effectively adjust classroom teaching activities to align teaching with industry needs.

In addition, HVCs need to attract talents from Meizhou's catering enterprises to build a part-time teacher team. By recruiting talents from enterprises, HVCs can strengthen the communication between full-time and part-time teachers, help them enrich practical experience, and master better Hakka cuisine cooking skills. Part-time teachers can bring enterprise experience and cutting-edge industry knowledge to enrich professional courses and help students understand real-world cases ^[15]. For instance, renowned Meizhou Hakka cuisine chefs can serve as part-time teachers at HVCs. They can visit the campus regularly to deliver lectures and provide practical guidance, helping students master more exquisite cooking techniques, gain a better understanding of industry development trends, expand their horizons, and effectively improve their professional quality, laying a solid foundation for their future employment.

4. Conclusion

In summary, based on the integration of industry and education and the work-study alternation model, HVCs can adjust the talent cultivation activities for Meizhou Hakka cuisine cooking, build a systematic project, and carry out comprehensive innovation from multiple perspectives. Specifically, HVCs can improve the curriculum connection mechanism to facilitate teaching exchanges between secondary and higher vocational education;

meanwhile, they can strengthen the construction of the teacher team, encourage teachers to participate in enterprise practice, and ensure the smooth implementation of subsequent professional talent cultivation. By adjusting the talent cultivation activities, HVCs can cultivate a group of professional talents, thereby promoting the promotion and inheritance of Meizhou Hakka cuisine.

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Research on the Application of Information-Based Flipped Classroom Teaching Model in Nursing Education of Rheumatology and Immunology Department

Yaqi Niu, Xiaoyan Li, Ning Li, Changjuan Li, Na Li, Hua Guo*

Shaanxi Provincial People's Hospital, Xi'an 710068, Shaanxi, China

**Author to whom correspondence should be addressed.*

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Abstract: Objective: To explore the application effect of an information-based flipped classroom teaching model in nursing education of rheumatology and immunology, providing empirical evidence for optimizing specialized nursing education models. Methods: Eighty nursing students from the 2021 grade of Xi'an Medical University were selected as research subjects and randomly divided into an experimental group ($n = 40$) and a control group ($n = 40$) using a random number table method. The control group received traditional lecture-based teaching, while the experimental group underwent information-based flipped classroom teaching. The theoretical knowledge scores and practical operation assessment scores of the two groups were compared after teaching, and the teaching satisfaction of the experimental group students was evaluated through a questionnaire survey. Results: The theoretical knowledge score (85.60 ± 5.20) and practical operation score (88.30 ± 4.70) of the experimental group were significantly higher than those of the control group (76.20 ± 6.50) and (75.80 ± 5.90), respectively. The differences were statistically significant ($p < 0.05$). The satisfaction scores of all dimensions in the experimental group were significantly higher than those in the control group, and the differences were statistically significant ($p < 0.05$). Conclusion: The information-based flipped classroom teaching model can effectively improve the quality of nursing teaching in rheumatology and immunology, enhance students' knowledge mastery and practical abilities, and is worthy of promotion and application in clinical nursing teaching.

Keywords: Information-based teaching; Flipped classroom; Rheumatology and immunology; Nursing education; Teaching effectiveness

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1. Introduction

Rheumatic and immunological diseases are a group of autoimmune diseases primarily manifested by joint,

muscle, bone, and related soft tissue lesions, characterized by a protracted course, complex condition, and high disability rate ^[1]. Clinical nursing work not only requires nursing staff to have solid theoretical knowledge but also demands precise operational skills and good clinical decision-making abilities. However, the passive “teacher speaks, students listen” model in traditional nursing education suffers from issues such as a disconnect between theory and practice and low student engagement, making it difficult for nursing students to quickly adapt to the complex nursing scenarios in rheumatology and immunology departments after entering clinical practice ^[2]. With the deep integration of “Internet + Education”, flipped classrooms provide a new approach to address the shortcomings of traditional teaching by reconstructing the teaching process, placing knowledge transfer before class and focusing on knowledge internalization and skill development during class ^[3]. This study combines information technology with the flipped classroom model to construct a new teaching model suitable for rheumatology and immunology nursing education, aiming to improve teaching quality and provide practical references for cultivating high-quality specialized nursing talents.

2. Materials and methods

2.1. Participants

Eighty undergraduate nursing students from a medical school’s 2022 intake were selected. All were full-time students who had completed basic medical courses and an introduction to nursing studies, but had no clinical internship experience in rheumatology and immunology. They were randomly divided into an experimental group and a control group, with 40 students in each group. The average age of the experimental group was (20.32 ± 1.24) years, while that of the control group was (20.54 ± 1.12) years. There was no statistically significant difference in general information between the two groups ($p > 0.05$), making them comparable. This study was approved by the school’s ethics committee, and informed consent forms was signed by all participants.

2.2. Teaching methods

2.2.1. Control group

(1) Theoretical teaching

The teacher has conducted classroom lectures according to the textbook chapters (“Rheumatology and Immunology” chapter in “Internal Medicine Nursing”), with 4 class hours per week for a total of 8 weeks

(2) Practical teaching

2 simulation operation practices were arranged after class, with teacher demonstration followed by student group practice

(3) Assessment method

A closed-book theoretical examination was conducted and operational assessment at the end of the semester.

2.2.2. Experimental group

The implementation of the flipped classroom model in rheumatology and immunology nursing was divided into two major stages, the teaching preparation stage and the implementation stage. During the teaching preparation stage, a specialized teaching team was established, consisting of three associate chief nurses from the Department of Rheumatology and Immunology, each with over ten years of clinical experience, and two

nursing education experts, responsible for program design and resource development.

An information-based teaching platform was constructed by utilizing the school's "Smart Nursing Teaching System", which integrated micro-lecture videos, around 10–15 minutes each, six virtual simulation modules including joint care for rheumatoid arthritis, an online question bank containing 300 specialized questions, and interactive discussion forums. In addition, a learning guide, titled "Rheumatology and Immunology Nursing Flipped Classroom Learning Manual", was compiled based on the teaching syllabus to clarify learning objectives, key points, challenges, and milestone tasks for each chapter.

During the implementation stage, the learning process was divided into three phases. In the pre-class autonomous learning phase, with about 30% of total learning time, teachers released learning tasks via the platform three days in advance. Students engaged in self-directed study by watching micro-lecture videos, including Operational Norms for Skin Care in Systemic Lupus Erythematosus, reading electronic lesson plans, completing timed online tests with automated scoring, and posting questions on the discussion forum. Teachers monitored learning progress and identified common issues using platform analytics. The classroom interactive internalization phase is about 40% of total time and has adopted a "problem-orientation–case discussion–skill practice" approach. For instance, when teaching nursing care for rheumatoid arthritis, teachers first analyzed high-frequency errors from pre-class tests, then organized students into six-member groups to discuss virtual cases such as nursing plans for patients with joint deformities and morning stiffness, followed by standardized patient simulations to practice nursing operations under teacher supervision and feedback.

In the post-class consolidation and expansion phase with 30% of the total time, the platform generated personalized assignments based on pre-class weaknesses, enabling students to repeatedly practice operational skills using the virtual simulation system and participate in weekly online case discussions, where clinical nurses shared real patient cases to enhance clinical relevance and knowledge retention.

2.3. Observation indicators

2.3.1. Knowledge and skill evaluation

(1) Theoretical knowledge

A unified test paper (reliability 0.86, validity 0.82) was used, covering disease mechanisms, nursing measures, and more., with a full score of 100 points.

(2) Practical operation

"Positional nursing for patients with ankylosing spondylitis" was selected as the assessment item, using the OSCE scoring criteria (operational standardization 40%, communication ability 30%, emergency handling 30%). Three examiners who were blinded to the scoring give on-site scores, and the average score was taken.

2.3.2. Teaching satisfaction survey

A self-made questionnaire (Cronbach's $\alpha = 0.91$) was used, including three dimensions, including teaching resources (3 questions), teaching methods (4 questions), and learning effects (3 questions), with a total of 10 questions. The Likert 5-level scoring system (1 = very dissatisfied, 5 = very satisfied) was used, with a total score of 50 points. A score of ≥ 40 points was indicated high satisfaction.

2.4. Statistical methods

SPSS 26.0 software was used to analyze the data. Measurement data was expressed as mean \pm standard

deviation ($\bar{x} \pm SD$), and independent sample t-tests were used for comparisons between groups. Count data were expressed as rates (%), and comparisons were made using the χ^2 test. $p < 0.05$ was considered statistically significant.

3. Results

3.1. Comparison of student performance between the two groups

The theoretical knowledge and practical operation scores of the experimental group are significantly higher than those of the control group, and the difference is statistically significant ($p < 0.05$). See **Table 1** for details.

Table 1. Comparison of assessment scores between the two groups of students ($\bar{x} \pm SD$, points)

Group	n	Theoretical knowledge	Practical skills
Experimental	40	85.60 \pm 5.20	88.30 \pm 4.70
Control	40	76.20 \pm 6.50	75.80 \pm 5.90
<i>t</i> -value		7.142	10.481
<i>p</i> -value		< 0.05	< 0.005

3.2. Student satisfaction in two groups

The satisfaction scores of the experimental group were significantly higher than those of the control group in all dimensions, and the difference was statistically significant ($p < 0.05$). See **Table 2** for details.

Table 2. Comparison of student satisfaction between two groups ($\bar{x} \pm SD$, score)

Group	n	Overall Satisfaction	Teaching Resources	Teaching Methods	Learning Outcomes
Experimental	40	42.52 \pm 3.67	4.54 \pm 0.55	4.33 \pm 0.62	4.22 \pm 0.76
Control	40	32.64 \pm 4.15	3.23 \pm 0.75	3.07 \pm 0.88	2.95 \pm 0.97
<i>t</i> -value		11.279	8.908	7.403	6.518
<i>p</i> -value		< 0.05	< 0.05	< 0.05	< 0.05

4. Discussion

Nursing care for rheumatic and immune diseases emphasizes “individualization” and “long-term management”. For example, patients with rheumatoid arthritis need to adjust their nursing plans based on joint mobility. Personalized assignments pushed by the information platform, such as nursing plan designs for different degrees of deformity has cultivated students’ clinical thinking. Real cases shared in online case discussions, such as “nursing care for the use of biological agents” and “flare-up period management of diseases”, compensate for the lag of textbook content behind clinical practice ^[4]. This study shows that the experimental group performed significantly better than the control group, confirming the advantages of flipped classrooms in specialized nursing education. From a cognitive psychology perspective, pre-class micro-courses reduce the difficulty of understanding abstract concepts through visual presentations, such as animated demonstrations of joint pathologies, while classroom case studies facilitate deep processing of knowledge through “clinical situation reproduction” ^[5]. The “trial-and-error” cycle provided by the virtual simulation system addresses the pain points of “fear of making mistakes and lack of opportunities” in traditional practical training, allowing students to

master operational skills in a safe environment ^[6].

Approximately 15% (6/40) of students reported low pre-class learning efficiency, mainly due to inadequate time management skills. The teaching team later adopted a “learning partner system” (grouping students based on complementary abilities) and a “task decomposition method” (breaking down large tasks into daily small goals), coupled with the platform’s timed reminder function, to increase the task completion rate from 78% to 95%. Initially, some micro-courses suffered from the problem of “focusing on knowledge while neglecting application”, such as only explaining pathological mechanisms without incorporating nursing scenarios. By inviting clinical nurses to participate in script design, practical content such as “morning care procedures for patients with morning stiffness” was added, and a resource update mechanism was established, including the revisions based on clinical guidelines every quarter, resulting in a 23% increase in the practicality score of resources ^[7]. The flipped classroom requires teachers to transition from being “lecturers” to “guiders”, but 80% of teachers initially struggled with “inappropriate intervention timing”. Through special training on “clinical case guidance skills” and establishing a teacher-student online interaction quality evaluation system, the effective classroom interaction duration increased from 35% to 68% ^[8].

This study found that combining the flipped classroom with PBL can further enhance the effectiveness: independent pre-class learning addresses “knowledge reserve” issues, while in-class PBL discussions focus on “clinical decision-making” abilities, forming a complementarity between the two ^[9]. For example, in teaching about systemic lupus erythematosus, students first grasp disease classification through micro-courses, and then engage in PBL discussions around “diet management controversies for patients with lupus nephritis”, which reinforces knowledge and cultivates critical thinking.

Besides significant improvements in theoretical knowledge and practical operation scores, the informatized flipped classroom also positively impacts students’ comprehensive abilities. During the independent pre-class learning stage, students need to independently plan their study time and filter important information, implicitly cultivating their self-learning ability and information literacy. The group discussion session in class requires students to actively express their views, listen to others’ opinions, and communicate effectively, greatly exercising their communication, collaboration, and teamwork skills. Taking rheumatology immunology’s common rheumatoid arthritis nursing teaching as an example, when discussing virtual cases in groups, students need to explore multiple aspects, including the pathophysiology, clinical manifestations, nursing assessment, and nursing measures of the disease. Students have different levels of understanding and mastery of knowledge points. During discussions, they complement and correct each other, which not only deepens their understanding of knowledge but also teaches them how to play their role in a team and solve problems together. Cultivating this ability is crucial for them to collaborate with other members of the healthcare team and complete nursing tasks when they enter clinical practice in the future. Meanwhile, when facing complex clinical cases and various unexpected situations, students need to use their knowledge to analyze, make judgments, and develop reasonable nursing plans. This enhances their clinical thinking and problem-solving abilities. For example, in a virtual scene dealing with positional nursing for patients with ankylosing spondylitis, students must consider factors like the patient’s pain level and joint movement restrictions. They must then choose an appropriate position and take corresponding nursing measures. This undoubtedly serves as a practical exercise for their clinical thinking and problem-solving skills.

Nursing students at different levels have varying knowledge reserves, learning abilities, and learning needs. Therefore, the application of the informatized flipped classroom needs to be appropriately adjusted according to the students’ levels to ensure teaching effectiveness. For undergraduate nursing students who already have

a certain foundation of medical knowledge and learning ability, the informatized flipped classroom can fully unleash their potential for independent learning. The teaching content can include more clinical case analyses and training in complex nursing skills, such as nursing for patients with rheumatic immune diseases combined with multiple organ damage. For college nursing students who have relatively shorter study durations and weaker basic medical knowledge reserves, it is necessary to reduce the difficulty of pre-class independent learning when applying the informatized flipped classroom. Micro-lecture videos should be more concise and focused on basic knowledge and operational skills. During classroom interaction, teachers should provide more guidance, and case discussions can start with simple cases, gradually increasing in difficulty. Meanwhile, during practical training, it is essential to increase the frequency of teacher demonstrations and guidance to ensure that students can master basic operational skills. For the continuing education of in-service nursing staff, the informatized flipped classroom offers unique advantages. Given the busy schedules and fragmented time of in-service nurses, the informatization platform allows them to flexibly arrange their learning according to their own time. The teaching content can be more focused on clinical advancements, new skills, and the handling of complex cases to meet their needs in practical work. Online case discussion sessions can invite senior clinical experts to share the latest clinical experiences and nursing methods, enabling in-service nurses to update their knowledge and improve their professional skills promptly.

With the continuous development of technology, the integration of informatized flipped classrooms with other emerging technologies has vast potential, which can further enhance the effectiveness of nursing education in rheumatology and immunology. Artificial intelligence technology can accurately analyze students' knowledge weaknesses based on their learning progress and test scores, pushing personalized learning resources and practice questions to achieve true individualized teaching. For instance, when the system detects that a student has deficiencies in medication nursing for rheumatoid arthritis, it can automatically push related micro-lecture videos, knowledge summaries, and practice questions to help the student targeted the learning process.

The incorporation of Virtual Reality (VR) technology can create more realistic clinical nursing scenarios for students. Through VR equipment, students can "enter" the rheumatology and immunology ward, interact with virtual patients, and simulate various nursing operations, such as performing skin care for patients with systemic lupus erythematosus or assisting patients with ankylosing spondylitis in changing positions. This immersive learning experience enables students to more intuitively experience the clinical nursing environment, improving their emergency response capabilities and operational proficiency. Big data technology can comprehensively analyze students' learning behaviors and outcomes, providing valuable reference information for the teaching team. By analyzing data such as students' online test scores, micro-lecture video viewing duration, and discussion forum participation, the teaching team can understand students' learning habits and difficulties, allowing timely adjustments to teaching plans and resources. At the same time, big data can also track and evaluate teaching effectiveness over the long term, providing data support for the continuous optimization of the information-based flipped classroom.

5. Conclusion

In summary, the information-based flipped classroom teaching model effectively improves the quality of nursing teaching in rheumatology and immunology through a closed-loop design of "precise pre-class guidance–in-depth internalization during class–personalized expansion after class". This model balances knowledge transmission and ability cultivation, meets the needs of specialized nursing education, and is worthy

of promotion and application.

In the future, it is necessary to further optimize the dynamic resource update mechanism, explore the application of artificial intelligence technology in personalized learning recommendations, and conduct in-depth research on the integration of this model with other emerging technologies, continuously improve the teaching system, and contribute to cultivating more high-quality rheumatology and immunology nursing talents^[10].

Disclosure statement

The authors declare no conflict of interest.

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A Practical Study on Integrating Chinese Culture into the Comprehensive English Course

Li Zhang*, Juan Zhang

Xinjiang Normal University, Urumqi 830054, Xinjiang, China

**Author to whom correspondence should be addressed.*

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Abstract: Integrating Chinese culture into classroom teaching is a requirement for the ideological and political construction of courses in institutions of higher learning. Due to its disciplinary attributes, the Comprehensive English course bears the mission of fostering cultural confidence and telling Chinese stories well in English. To fulfill this mission and responsibility of Comprehensive English in terms of Chinese culture, this paper proposes practical paths for integrating Chinese culture into the course. It suggests focusing on textbook texts to explore cultural elements, expanding resources to enhance the representational ability of cultural content, demonstrating diverse cultural investigation methods through in-depth teaching, innovating tasks to improve the communication power of Chinese culture, and emphasizing evaluation to pay attention to the effect of Chinese culture learning. By doing so, Chinese culture can be integrated into teaching, and students' ability to tell Chinese stories well in English can be enhanced.

Keywords: Chinese culture; Comprehensive English; Cultural teaching; Tell Chinese stories well

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1. Introduction

Chinese culture is an important part of the ideological and political construction of courses in institutions of higher learning, and it is the foundation for college students to foster cultural confidence. As a discipline where multiple cultures converge, foreign language studies attach great importance to cultivating cultural confidence. The Teaching Guidelines for Undergraduate Programs in Foreign Languages and Literatures in Regular Institutions of Higher Learning clearly states the requirement: "Cultivate English professionals with Chinese feelings, international vision, and firm confidence in Chinese culture, who adhere to the stance of Chinese culture in the exchange and mutual learning of civilizations, and tell Chinese stories well and spread Chinese voices effectively" ^[1]. Against this backdrop, Comprehensive English, as a basic course for English majors, is duty-bound to take on the contemporary responsibility of broadening international horizons, enhancing cultural confidence, and telling Chinese stories well. However, in teaching practice, due to the course's fundamental nature, a large proportion of time is allocated to English basic skills training, while

cultural attention is insufficient. The integration of Chinese culture is relatively low, and the integration methods are rather single. Additionally, there are problems such as insufficient depth in Chinese culture learning and inadequate development of students' ability to tell Chinese stories well. Therefore, based on teaching practice, this paper discusses the inherent significance, existing problems, and integration paths of Chinese culture in the Comprehensive English course, aiming to contribute to the course's fulfillment of its due responsibilities.

2. The proper meaning of Chinese culture in integrated English courses

Linguistic symbols are the necessary tools and conditions for cultural communication and inheritance, serving as the carrier of culture^[2]. "All cultures are acquired through learning, and in the process of cultural learning, various interactive transmission methods used by people usually rely on language"^[3]. Due to its wide range of humanistic themes, integrated English has a unique advantage in cultivating cultural awareness. In terms of Chinese cultural cultivation, integrated English courses should aim to build cultural confidence and present a credible, adorable, and respectable image of China to the world, with Chinese traditional culture, core values, and various cultural achievements of the new era as the content of Chinese cultural learning.

3. Objectives of Chinese cultural cultivation in integrated English courses

3.1. Builds cultural confidence

"Culture is the soul of a country and a nation". "A nation prospers when its culture prospers, and a nation is strong when its culture is strong". "Strengthening cultural confidence is a major issue that concerns the rise and fall of the country, cultural security, and the independence of the national spirit". For those engaged in foreign language-related fields, cultural confidence is the foundation for cross-cultural communication and the stance and basic attitude for cultural exchange and mutual learning. "If the value of Chinese cultural awareness in language learning is ignored, cross-cultural communication will lose its due foundation of discourse power"^[4]. In foreign language education, an international perspective and cross-cultural communication skills should be based on Chinese feelings and cultural roots^[5]. Therefore, integrated English courses need to guide students to establish national cultural confidence on the premise of learning, understanding, and respecting foreign cultures, and avoid the tendency of worshipping foreign things and belittling China while praising the West.

3.2. Presents a credible, adorable, and respectable image of China to the world

National image refers to the understanding and evaluation of a country's politics, economy, society, culture, geography, and other aspects by domestic and foreign publics^[6]. The construction of national image targets two groups: domestic and foreign. Currently, the international presentation of China's national image is a requirement for the "Belt and Road" Initiative and the country's external publicity. As an important international language, English is a key tool for "telling Chinese stories well" and "spreading Chinese voices". For example, by learning how to narrate in English, tell Chinese stories about cultural China, model China, and contemporary China, we can present a credible, adorable, and respectable national image to the world. To this end, integrated English courses need to improve students' ability to represent and disseminate Chinese culture simultaneously.

3.3. Enriches the contents of Chinese cultural learning in Integrated English course

Culture refers to "the sum of material and spiritual wealth created by humans in the process of social and historical development, especially spiritual wealth such as literature, art, education, and science"^[7]. Therefore,

the content of Chinese culture in Integrated English courses should also cover various aspects, such as Chinese traditional culture, local native culture, core values, and various civilizational achievements of the new era. In addition, Integrated English is a course that cultivates students' comprehensive English skills, and the themes of the selected materials involve rich fields such as man and nature, man and society, and man and self, including material culture such as clothing, food, architecture, transportation, behavioral culture such as etiquette and customs, institutional culture such as economy, politics, law, education, and spiritual culture such as ideological theories, moral norms, literature, and art. All these themes can be integrated with Chinese culture^[8].

4. Implementation paths for integrating Chinese culture

To fulfill the mission and responsibility of Integrated English regarding Chinese culture, the following section explores strategies for integrating Chinese culture based on teaching examples from Volumes 1–4 of *A Course in Comprehensive English* (3rd Edition) by Zou Weicheng.

4.1. Focus on textbook texts and explore cultural elements

Textbooks are the main front for cultural teaching, and the excavation of textbook texts is primarily aimed at finding connection points for Chinese culture to naturally integrate it. To this end, teachers should deeply explore the connotations and context of textbooks, skillfully identify entry points for Chinese stories from ancient and modern times, ensure that education on the connotations of Chinese culture is naturally permeated in teaching, and inspire diverse thinking through group text reading. For example, Unit 1 of Book 2 focuses on the topic of the relationship between humans and animals under the theme of “Man and Nature”, including a total of five texts.

The first is a listening text in the form of an interview, which tells the story of an American father taking his child to visit a chicken farm, where the living conditions of the chickens made the child uncomfortable. The second text is a cartoon showing a couple taking a little girl to see a black bear exhibition: two bears are kept behind iron bars, and the father bear is holding a sign outside the bars that reads “My son is innocent”. The third text, “The Snake Bite”, is a narrative that tells the story of an American rural boy who was bitten on the foot by a snake while picking watermelons; his mother then took first-aid measures and finally asked a neighbor for help to send him to the hospital, where he was saved. The fourth text is Emily Dickinson's poem “Snake”, which describes the snake's elusive presence in the grass. The fifth text is a short expository passage for dictation, which talks about the importance of pets in British culture.

Additionally, there is a narrative entitled “Misunderstanding”, which tells the story of a pet baboon and a chicken during the mid-19th century when a British regiment was stationed in Jamaica: the baboon loved the chicken extremely, but its way of showing affection was a torment for the chicken, which eventually could not bear it and died. Finally, the cultural information section is designed as a cultural research task entitled “Friends or Enemies”, which presents the symbolic meanings of various animals in British and American cultures and requires students to explore the characteristics of these animals in Chinese culture through interviews. The theme, topic, and task types of this unit all provide connection points for Chinese culture, which can be linked to cultural information such as discussions on the relationship between humans and animals in Chinese culture, Chinese poultry farming methods, traditional Chinese pets, the metaphorical meanings of various animals in Chinese culture, and the differences between Chinese and Western auspicious animals.

4.2. Expand resources to enhance the representational ability of cultural content

For the Chinese cultural connection points based on textbook themes, teachers need to expand resources to expose students to sufficient linguistic representations of Chinese culture. Specifically, two types of English resources can be utilized. First, classic Chinese cultural translations or original English works. For example, various English translations of *A Dream of Red Mansions* and Lin Yutang's *Moment in Peking* depict all aspects of traditional Chinese culture against different historical backdrops, providing rich linguistic representations for describing China in various periods. Regarding the animal theme of this unit, teachers can expand by introducing Xu Yuanchong's English translation of "Ode to the Goose" from his *300 Tang Poems*, and also supplement Yuan Zhen's "Ba Snake" to echo Emily Dickinson's "Snake", allowing students to appreciate the unique rhythmic beauty of Chinese and English poetry respectively. In addition, teachers can ask students to consult *A Dictionary of English Translations of Chinese Proverbs and Maxims* or English versions of books from the series on inheriting fine traditional Chinese culture published in recent years, to read animal-related proverbs, maxims, and idiom stories, such as "Gouweixudiao" (Wagging the dog) and "Jiaotusanku" (The wily hare). The second type is multimodal resources from various online platforms.

4.3. In-depth teaching to demonstrate diverse cultural investigation methods

On the basis of strengthening students' knowledge of English representations of Chinese cultural content, students also need to learn methodological knowledge for investigating cultural phenomena, such as comparison, analysis, evaluation, and innovation, as well as value-based knowledge regarding attitudes, perspectives, and emotions toward culture, including cultural differences, building cultural confidence, and daring to engage in critical thinking and innovation.

Therefore, in teaching cultural content, various cultural investigation methods should be applied in combination with the cultivation of critical thinking skills. For instance, Unit 11 "Man and Society" in Book 2 discusses topics related to school education systems and introduces the educational systems of Britain and the United States. When integrating cultural knowledge about China's ancient and contemporary school education systems, teachers can conduct comparisons and explanations based on differences between Chinese and Western examination systems. When sorting out information from the unit's second text "Teenager's Nightmare," teachers can ask students about the synesthetic content in the text with questions like "Do you feel the same way?" to arouse resonance and engagement.

Furthermore, when content different from Chinese culture appears, teachers can incorporate a cultural perspective by asking questions such as, when did the phenomenon of receiving report cards via mail occur? Why was that the case? Is this still true today? How do you receive your grades? This enables students to gain explanations for social phenomena mentioned in various texts from historical, social, and cultural perspectives, thereby learning how to conduct cultural analysis and evaluation. In this process, teachers can connect the distinct characteristics and social realities of China's ancient and contemporary eras to inspire students to reflect on educational systems. This helps students rationally grasp the traits of domestic and foreign institutional cultures, understand the development, strengths, and weaknesses of China's college entrance examination system, recognize the diversity of the world, and develop a dialectical and objective cultural attitude.

Teachers also need to design a variety of practical activities involving cultural experience and exploration, providing students with opportunities to describe, compare, analyze, evaluate, and innovate regarding cultural phenomena. Through experiencing different cultural activities, students can engage with traditional Chinese excellent culture, savor its essence and connotations, understand cultural differences, build cultural confidence,

and develop a tolerant attitude toward foreign cultures.

4.4. Innovate tasks to enhance the dissemination power of Chinese culture

The dissemination of Chinese culture by foreign language learners is based on cultural confidence, which requires rich and positive cultural experiences as well as the enhancement of cultural dissemination capabilities. Teachers need to innovate cultural learning tasks, connect them with real life, and realize them through various practical activities. For example, when learning Unit 15 “William Shakespeare: His Life and Works” in Book 3, exploratory project-based learning tasks can be designed to guide students to explore the origins and characteristics of China’s five major opera genres or other local opera forms in combination with their own regions. Based on this, teachers can design project-based assignments: students are required to understand and record the value and inheritance of intangible cultural heritage (ICH) such as the Sayram Lake Puppet Show in local areas through literature review and in-person interviews, translate the content into English, and present it in the form of promotional posters or videos.

When learning Unit 6 “Chinese Food” in Book 4, teachers can also ask students to experience local characteristic cuisines, conduct research, and narrate their origins and development in English, they can create knowledge structure diagrams, write promotional articles, or record introduction videos in English modeled after the documentary such as *A Bite of China*.

4.5. Emphasize assessment and focus on the learning effects of Chinese culture

The integration of Chinese culture content aims to enhance students’ cultural confidence and the international dissemination power of Chinese culture. Therefore, the learning effects of Chinese culture can be evaluated through the explicit manifestations of learning outcomes. In this regard, Zhang Yuhong suggests assessing students’ ability to “tell Chinese stories well in English” to examine their English application skills, Chinese cultural literacy, and intercultural communication competence^[9]. For performance assessment, teachers can try to implement it with reference to the learning-oriented performance assessment quality analysis framework proposed by Zhou Wenye et al., designing assessments from three aspects: performance objectives, assessment tasks, and assessment criteria^[10]. For instance, in Unit 10 “The Life Story of an Ancient Chinese Poet” in Book 2, students need to recommend a Chinese writer through literature research and reading, and be assessed based on their task presentation. Corresponding objectives should be set for the literature research process, reading process, and final presentation of results.

5. Conclusion

Cultural teaching is not only about imparting cultural knowledge, but more importantly, about guiding beliefs and setting examples through actions. As the saying goes, “If a leader is upright, his words will be followed without command; if he is not upright, his commands will not be obeyed even if enforced”. Therefore, as a link for the transmission of traditional Chinese culture, teachers have the most direct influence on students. Teachers must attach importance to learning traditional Chinese culture, accumulate richer linguistic expressions for Chinese cultural concepts, update their knowledge by reading foreign publicity books and periodicals, watch audio-visual materials on Chinese culture, take online courses, and learn to think and apply this knowledge in practice.

Disclosure statement

The authors declare no conflict of interest

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Research on the Construction and Reform of Ideological and Political Education in College Physical Education Track and Field Courses

Bahetibieke Wulalebieke

Yili Normal University, Yining 835000, Xinjiang, China

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Abstract: With the proposal of the fundamental task of “fostering virtue through education”, ideological and political education in colleges and universities has ushered in new opportunities for reform. Against this backdrop, how to more effectively cultivate students’ political literacy and comprehensive abilities has become one of the teaching challenges perplexing college teachers. In response, teachers should uphold the concept of ideological and political education in courses, and integrate it into teaching according to the characteristics of the courses and students’ needs, so as to realize the organic unity of knowledge imparting and value guidance. In this regard, this paper briefly analyzes the construction of ideological and political education in college physical education track and field courses, hoping to provide some valuable references for readers.

Keywords: College physical education; Track and field; Ideological and political education in courses

Online publication: Oct 22, 2025

1. Introduction

In nowadays, colleges and universities are comprehensively advancing the “all-round education” and implementing the fundamental task of “fostering virtue through education”, ideological and political education in courses has received widespread attention and emphasis from colleges and universities, and has gradually become an important direction of higher education reform^[1]. As an important part of China’s higher education system, college physical education undertakes multiple tasks such as cultivating students’ sports knowledge, enhancing their physical fitness, and strengthening their will quality. The track and field course is an important component of college physical education teaching, with distinct characteristics, and has unique advantages in promoting the construction of ideological and political education in courses. Integrating ideological and political elements into track and field teaching can not only impart track and field knowledge to students, improve their sports level and physical fitness, but also help students form correct ideological concepts and value cognition, which can be described as achieving multiple goals at once. However, there are many problems in the construction of ideological and political education in college physical education track and field courses^[2]. In

this regard, college teachers should keep up with the trend of the times and actively explore effective strategies to promote the construction of ideological and political education in courses and lay a solid foundation for students' all-round development in the future.

2. Significance of ideological and political construction in university physical education track and field courses

Integrating ideological and political elements into the teaching of university physical education track and field courses holds significant practical importance. In this regard, this paper briefly elaborates on the following aspects.

2.1. An inevitable requirement for implementing the fundamental task of “moral education and talent cultivation”

“Moral education and talent cultivation” is the fundamental task of higher education. Universities should keep up with the trend of the times and cultivate socialist builders and successors with both virtue and talent^[3]. The ideological and political construction of university track and field courses can integrate ideological and political education into the entire teaching process. While imparting track and field knowledge and skills to students, it shapes their positive and progressive character, promotes the development of their sense of competition and striving spirit, and gradually guides students to establish correct ideological concepts and value perceptions. It is an effective way to implement the fundamental task of “moral education and talent cultivation”.

2.2. An effective measure to improve the teaching effect of track and field courses

In the past track and field teaching, teachers often focused on imparting sports skills and physical education knowledge, while neglecting the cultivation of students' ideology, concepts and cognition. This led to the lack of comprehensive quality improvement for students in the learning process, laying hidden dangers for their comprehensive development in the future^[4]. Actively carrying out the ideological and political construction of track and field courses can not only enrich teaching content, expand teaching forms, and effectively stimulate students' learning interest, but also inject new connotations into track and field courses. This enables physical education to break through the limitation of “physical cultivation” and realize the organic unity of “physical cultivation” and “moral cultivation”, thereby further improving the effect and quality of track and field teaching.

2.3. A key link in inheriting and promoting the spirit of sports

Track and field have a long history of development, containing rich cultural connotations and moral education elements, and is an important carrier for promoting the construction of ideological and political courses. By digging deep into the ideological and political elements in track and field teaching, students can be effectively encouraged to inherit and promote the spirit of sports^[5]. In track and field teaching, students can not only learn various sports knowledge and skills, but also deeply understand the sports connotation of never giving up and perseverance, thereby shaping excellent character, better practicing socialist core values, and laying a solid foundation for their comprehensive development in the future.

3. Problems existing in the construction of ideological and political education in track and field courses in the past

3.1. Ideological and political elements are superficially integrated and lack organic integration

In the previous construction of ideological and political education in track and field courses, some teachers failed to fully integrate ideological and political education with track and field teaching, resulting in the construction being a mere formality and the educational effect being insignificant^[6]. For example, in teaching practice, some teachers simply read out moral norms or patriotic slogans to students without deeply integrating them with the content of track and field teaching. This leads to a “stratification phenomenon” between the two, which not only seriously affects students’ learning of sports knowledge but also hinders the cultivation of their political literacy.

3.2. Insufficient ideological and political literacy of the teaching staff and lack of professional training

Teachers are not only important organizers and participants in course teaching but also the main force in promoting the construction of ideological and political education in courses^[7]. However, some track and field teachers have weak ideological and political literacy themselves and lack professional and effective training. In the process of constructing ideological and political education in courses, they often feel inadequate and struggle to integrate ideological and political elements into track and field teaching, thus affecting the improvement of educational effects. In this regard, colleges and universities should strengthen the construction of the teaching staff and continuously improve their ideological and political literacy to lay a solid foundation for promoting the construction of ideological and political education in courses.

3.3. Single teaching methods and lack of innovation

In the construction of ideological and political education in track and field courses, some teachers still adhere to the traditional teaching mode, mainly focusing on “teacher demonstration + student practice”. The lack of innovation in teaching methods makes ideological and political education less attractive and fails to stimulate students’ learning interest. As a result, students are prone to feelings of boredom and tediousness in the learning process, which has a certain impact on the educational effect of ideological and political education in courses^[8]. In response, teachers should keep up with the trend of the times, actively explore diversified teaching modes, optimize course content, and design more interesting classroom activities to lay the foundation for promoting the construction of ideological and political education in courses.

3.4. Imperfect evaluation system and lack of scientific basis

At present, the evaluation system of some college physical education track and field courses is not perfect. It mainly takes students’ sports scores and sports skill assessments as evaluation indicators, lacking an evaluation mechanism for students’ political literacy^[9]. Due to the lack of a scientific and perfect evaluation system, the evaluation results are not comprehensive, making it difficult to measure the effect of ideological and political education construction in courses. At the same time, it is also difficult to effectively feedback and guide teachers’ teaching behaviors and students’ learning effects, which to a certain extent affects the progress of the construction of ideological and political education in courses.

4. Innovative strategies for the ideological and political construction of university physical education track and field courses

4.1. Deeply excavate ideological and political elements to achieve in-depth integration

4.1.1. Excavate patriotic elements to cultivate students' patriotic feelings

Track and field are not only an important part of international sports events, but also a key window for China to demonstrate its national sports strength^[10]. In this regard, during the ideological and political construction of track and field courses, teachers can combine the development history of China's track and field, such as telling students the historical stories of track and field athletes who strived for national glory, like Liu Changchun, who traveled across the ocean to compete alone; Liu Xiang, who broke the world record in the 110-meter hurdles; and Su Bingtian, who achieved historic accomplishments in the 100-meter race. These stories help cultivate students' patriotic feelings and strengthen their national pride and sense of mission.

4.1.2. Excavate teamwork elements to cultivate students' collective honor

In track and field teaching, teachers can organize and carry out interesting team projects according to the teaching content and students' needs, such as tug-of-war, fun relays, and three-person two-leg races. This approach not only stimulates students' interest in participation and mobilizes their enthusiasm and initiative, but also strengthens their cognition and effectively cultivates their teamwork ability and collective sense of honor.

4.1.3. Excavate will quality elements to shape students' excellent character

Track and field have high requirements and standards for students' physical fitness and will quality, requiring them to have a tenacious and unyielding spirit. To this end, teachers can tell students stories of track and field athletes who overcame their own difficulties and persisted in training and competitions. This guides students to establish correct ideological concepts and value perceptions, thereby shaping their excellent character.

4.2. Strengthen the construction of teaching staff to improve teachers' ideological and political competence

4.2.1. Conduct regular special training

Colleges and universities can regularly organize physical education teachers to participate in special training on ideological and political course construction, inviting renowned experts and outstanding peers to give training. This helps improve physical education teachers' political literacy and teaching level, laying a foundation for promoting the construction of ideological and political courses.

4.2.2. Encourage teachers to carry out ideological and political research

Colleges and universities should encourage teachers to conduct research related to ideological and political course construction, set up research projects, and encourage teachers to carry out ideological and political education research based on the characteristics of track and field teaching and the actual situation of college students. This way, innovative paths suitable for the ideological and political construction of track and field courses can be explored, thereby improving teachers' research capabilities in ideological and political education.

4.2.3. Build an efficient communication platform

Colleges and universities can also leverage the advantages of information technology to build a communication platform for physical education teachers' ideological and political course construction, such as WeChat groups and QQ groups. This provides a platform for teachers to share teaching experiences and exchange educational

insights. At the same time, colleges and universities can regularly organize teachers to participate in teaching seminars, where they share the problems encountered in the construction of ideological and political courses and jointly explore effective solutions, thereby improving physical education teachers' ideological and political literacy and teaching level.

4.3. Optimize teaching methods and innovate teaching means

4.3.1. Adopt case teaching method

In track and field teaching, teachers can select cases of outstanding track and field athletes such as their training methods, dietary plans, and competition strategies based on the teaching content and students' actual athletic levels. These cases should be analyzed and explained in combination with ideological and political education goals. This approach strengthens students' cognition, enables them to gain a deeper understanding of the ideological and political connotations in track and field, thereby stimulating their learning interest and promoting the integration of ideological and political education into the curriculum.

4.3.2. Apply artificial intelligence technology

Due to the advancement of science and technology, artificial intelligence has already been widely and extensively applied in multiple sectors, and in our field, teachers can introduce AI technology into track and field courses to improve teaching effectiveness. For example, by having students wear smart devices to monitor sports data such as heart rate, step count, and calories burned, teachers can accurately grasp each student's athletic level and physical condition, and adjust teaching plans accordingly. In addition, teachers can use virtual reality technology to create virtual scenarios. This not only helps students better understand the rules and tactical applications of track and field competitions but also stimulates their learning interest and further enhances the educational effect of the course. Furthermore, big data technology can be integrated into teaching to improve the pertinence of track and field instruction. A large amount of sports data is generated during students' track and field training; by utilizing the data collection and analysis functions of big data, coaches can develop personalized training plans for students. This not only effectively improves the quality of track and field teaching and students' training levels but also enhances their learning efficiency.

4.3.3. Carry out practical teaching activities

Practical activities are an effective carrier for promoting the integration of ideological and political education into the curriculum. In this regard, college teachers can actively organize and carry out various types of practical activities, such as track and field competitions and fun running events. This not only stimulates students' interest in participation and cultivates their sense of competition but also strengthens their teamwork and communication skills. During their participation in these sports activities, students have the opportunity to improve their physical fitness and track and field training levels, while also learning to cope with various difficulties and challenges in practice, helping them develop a resolute and brave character. Moreover, these activities are conducive to students' all-round development, including the improvement of physical and mental health as well as social skills. They also enhance class cohesion and promote mutual understanding and friendship among students. By participating in these activities together, students will establish closer connections, laying a solid foundation for them to enter society and face more complex interpersonal relationships and work challenges in the future.

4.4. Improve the evaluation system and establish a scientific mechanism

The previous evaluation system for track and field courses was incomplete and could hardly effectively promote the integration of ideological and political education into courses. In this regard, in the new era, colleges and universities should actively improve the evaluation system and build a scientific feedback mechanism to lay a solid foundation for students' all-round development in the future.

4.4.1. Build a diversified evaluation system

A diversified index evaluation system should be constructed, which not only focuses on students' physical education scores and sports skill assessments but also evaluates their ideological and political literacy. The evaluation content includes but is not limited to teamwork ability, innovation ability, will quality, and patriotic feelings. At the same time, the evaluation methods should also be diversified, adopting a combination of teacher evaluation, student self-evaluation, and peer evaluation to ensure the objectivity and fairness of the evaluation results.

4.4.2. Establish a feedback mechanism

Based on the evaluation results, timely feedback on the problems and shortcomings in ideological and political education should be provided to students and teachers. For the problems existing in students, targeted counseling and education should be carried out; for the problems existing in teachers, improvement opinions and suggestions should be put forward to promote the continuous improvement and development of the integration of ideological and political education into courses.

5. Conclusion

In conclusion, promoting the integration of ideological and political education into track and field courses is of great practical significance for students' all-round development in the future. In this regard, colleges and universities as well as physical education teachers should fully recognize the important value of integrating ideological and political education into courses, and according to the characteristics of track and field courses and students' learning situation, use various methods and means to more effectively improve the teaching effect of the course, give full play to the educational role of integrating ideological and political education into courses, and thus lay a foundation for students' all-round development in the future.

Disclosure statement

The author declares no conflict of interest.

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Research on the Cultivation of Top-notch Innovative Talents in Universities from the Perspective of the Integration of Education, Science and Technology, and Talent

Yue Zhang*

Party Committee Office of Jiangsu University, Zhenjiang 212013, Jiangsu, China

**Author to whom correspondence should be addressed.*

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Abstract: To better clarify the impact of the integration of education, science and technology, and talent on the cultivation of top-notch innovative talents in universities, this study adopts the fuzzy-set Qualitative Comparative Analysis (fsQCA) method. Using 23 universities in China as the research sample, the findings reveal that: (1) none of the three individual factors, education, science and technology, or talent can independently constitute either a necessary or sufficient condition for high-quality cultivation of top-notch innovative talents; (2) the sufficient condition for achieving high-quality cultivation lies in specific configurations of multiple condition variables; (3) five configurations were identified, from which three distinct paths toward achieving high-quality cultivation were derived. Accordingly, different universities can, based on their own resource endowments and local contexts, select appropriate cultivation paths to effectively enhance the quality of top-notch innovative talent training.

Keywords: Top-notch innovative talents; Cultivation quality; Education–science–talent integration; Qualitative comparative analysis; Configuration

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1. Problem statement

Several problems remain in the cultivation of top-notch innovative talents. First, the adaptability of cultivation models to university-specific contexts is limited, with a notable trend of homogenization. Huang Luhan's analysis revealed both imitative and normative convergence in cultivation practices^[1]. Under policy and evaluation pressures, universities often replicate existing models rather than exploring innovative approaches tailored to their unique conditions. However, due to variations in institutional positioning and resource allocation, this imitation often fails to achieve the intended effect, leading to the paradox of “good methods applied to excellent students with limited success.” Second, universities often emphasize foundational training

but lack sufficient focus on cultivating innovation capabilities. Tan Zhixiong and colleagues found that institutions emphasized comprehensive knowledge and solid disciplinary foundations through curriculum design and pedagogical strategies^[2]. Third, insufficient resource support poses significant challenges. According to a survey by An Guoyong and colleagues, issues such as ambiguous standards, inadequate resources, limited curriculum development, underdeveloped faculty teams, and insufficient teaching resources negatively affect cultivation quality^[3]. Since talent cultivation is influenced by universities' educational capacity, scientific development, and talent team support, disparities in resource security result in uneven development and prominent shortcomings across institutions.

Based on this, the present study focuses on three key factors influencing the cultivation of top-notch innovative talents in universities: educational resources, scientific development and talent quality. By analyzing the intrinsic relationships between education, science, talent, and the quality of talent cultivation in universities, this study develops a conditional configuration model, thereby providing theoretical support for different types of universities to explore characteristic pathways for cultivating top-notch innovative talents.

2. Research design

2.1. Research method

In the 1980s, American sociologist Charles C. Ragin proposed the Qualitative Comparative Analysis (QCA) method. QCA enables the in-depth analysis of multiple cases, capturing the complex structural relationships between conditions and outcomes. By integrating qualitative and quantitative approaches, QCA identifies how outcomes are influenced under different combinations of conditions^[4,5]. Depending on the type of variables, QCA is categorized into three types: crisp-set QCA (csQCA), multi-value QCA (mvQCA), and fuzzy-set QCA (fsQCA), csQCA and mvQCA are suitable for analyzing dichotomous or multi-value categorical variables, i.e., problems addressed through crisp sets and truth tables. In contrast, fsQCA converts fuzzy-set data into truth tables, enabling the analysis of degrees of variation and partial membership. It combines the strengths of qualitative and quantitative analysis^[6]. Therefore, this study adopts fsQCA for the empirical analysis.

2.2. Data sources

The data for this study were drawn from multiple sources, including the 2022 departmental final accounts published by universities, the CUAU 2020 China First-Class University and Double First-Class Construction Evaluation Report, the iResearch 360-Degree University Panorama Data Monitoring Report (October 2023), and the China University Ranking (CNUR) 2022 Student Quality Report. Considering data completeness, 23 universities were ultimately selected as the research sample: Peking University, Tsinghua University, Beijing Institute of Technology, China Agricultural University, Beijing Normal University, Nankai University, Tianjin University, Jilin University, Fudan University, Tongji University, Shanghai Jiao Tong University, East China Normal University, Southeast University, Zhejiang University, University of Science and Technology of China, Shandong University, Ocean University of China, Wuhan University, South China University of Technology, Chongqing University, Sichuan University, Xi'an Jiaotong University, and Lanzhou University.

2.3. Variable design

2.3.1. Outcome variable

The ranking of Chinese universities in innovative talent cultivation quality, as reported in the CUAU 2020 China First-Class University and Double First-Class Construction Evaluation Report, was selected as the outcome

variable.

2.3.2. Condition variables

(1) Educational level

This dimension includes funding input, talent cultivation, discipline construction, and international exchange and cooperation. Funding input includes five indicators including curriculum and teaching materials, teaching projects, teaching achievement awards, teaching bases and program construction. Discipline construction includes national key disciplines, and those recognized by the Ministry of Education. International exchange and cooperation were measured by three indicators including Sino-foreign cooperative education institutions and programs, visits from foreign political leaders and the number of honorary doctoral degrees awarded.

(2) Scientific development

This dimension includes scientific research and social services. Scientific research is measured by three aspects: research bases, research projects, and research achievements. Social services include three aspects: service bases, patents/standards/popular science outputs, and the monetary value of technology transfer.

(3) Talent team

This dimension includes student quality and faculty strength. Student quality is measured using two indicators: science or engineering students and liberal arts students. Faculty strength is measured across four aspects, including role models in moral education, leading top-level talents, outstanding mid-career talents, and promising young talents.

2.3.3. Variable calibration

In accordance with the characteristics of the case study and the actual data distribution, the direct calibration method was employed. Following the calibration criteria of Lu Yu et al. and Zhang Lingang et al., the upper quartile, median, and lower quartile were selected as the three anchor points, corresponding to full membership, the crossover point, and full non-membership, respectively, for data calibration ^[7,8].

3. Empirical results analysis

3.1. Necessity analysis

Using the fsQCA software, we conducted a necessity analysis of the conditional variables to determine whether a single condition constitutes a necessary prerequisite for the outcome. The two key indicators in necessity analysis are consistency and coverage, where a consistency threshold higher than 0.9 is typically required, along with an adequate level of coverage ^[9]. The consistency values of the eight conditional variables for both high and non-high training quality of top-notch innovative talents are all below 0.9. This indicates that the cultivation quality of top-notch innovative talents does not rely on any single condition.

3.2. Configuration analysis

Using fsQCA 3.0 software, the truth table was analyzed to obtain the “complex solution,” “parsimonious solution,” and “intermediate solution.” Core conditions are those that appear in both the parsimonious and intermediate solutions, while peripheral conditions are those present only in the intermediate solution ^[5]. As shown in **Table 1**, the consistency values of these five configurations are all exceeding the theoretical threshold

of 0.8. This indicates that each configuration meets the consistency requirement across all cases in this study. The overall consistency of the model is 0.959036, again surpassing the threshold of 0.8, further confirming that these five configurations are sufficient conditions for high-quality cultivation. In addition, the model solution coverage is 0.70318, suggesting that the conditional variables explain a substantial proportion of the reasons behind high-quality cultivation of top-notch innovative talents.

Table 1. Configuration results of high-quality training of top innovative talents in universities

Condition Variable	Configuration 1a	Configuration 1b	Configuration 2a	Configuration 2b	Configuration 3
Funding Input	●	×	●	●	×
Talent Cultivation		×		●	●
Discipline Construction	●	×	●	×	●
International Exchange & Cooperation	●	●	×	●	×
Scientific Research	●	●	×	×	●
Social Services	●	●	×	×	●
Quality of Student Sources	●	●	●	●	×
Faculty Team	●		●	●	●
Raw Coverage	0.532	0.101	0.087	0.116	0.103
Unique Coverage	0.423	0.049	0.047	0.051	0.016
Consistency	0.989	0.974	0.873	0.949	0.867
Overall Coverage			0.703		
Overall Consistency			0.959		

Note: (1) A solid dot in the table indicates the presence of a conditional variable. Among them, “●” denotes a core condition, while “●” denotes a peripheral condition; (2) The symbol “×” indicates the absence of a conditional variable; (3) A blank space represents a fuzzy condition, meaning that the condition may either be present or absent.

3.2.1. Configuration 1a

This configuration takes scientific research, social services, and student quality as the core conditions, and funding input, discipline construction, international cooperation, and faculty strength as the peripheral conditions. Approximately 98.9% of the cases with high-quality cultivation of top-notch innovative talents can be explained by this configuration, and about 42.3% of the cases can only be explained by this path. Representative universities include Peking University, Tsinghua University, Shanghai Jiao Tong University, Zhejiang University, and Fudan University.

3.2.2. Configuration 1b

This configuration takes scientific research, social services, and student quality as the core conditions, and international cooperation as the peripheral condition. Approximately 97.4% of the cases with high-quality cultivation of top-notch innovative talents were explained by this configuration, and about 4.9% of the cases can only be explained by this path. The representative university is Nankai University.

3.2.3. Configuration 2a

This configuration takes student quality as the core condition, and funding input, discipline construction, and

faculty strength as the peripheral conditions. Approximately 86.8% of the cases with high-quality cultivation of top-notch innovative talents can be explained by this configuration, and about 4.7% of the cases can only be explained by this path. The representative university is the University of Science and Technology of China (USTC).

3.2.4. Configuration 2b

This configuration takes student quality as the core condition, and funding input, talent cultivation, international cooperation, and faculty strength as the peripheral conditions. Approximately 94.9% of the cases with high-quality cultivation of top-notch innovative talents were explained by this configuration, and about 5.1% of the cases can only be explained by this path. The representative university is Sichuan University.

3.2.5. Configuration 3

This configuration takes scientific research and social services as the core conditions, and talent cultivation, discipline construction, and faculty strength as the peripheral conditions. Approximately 86.7% of the cases with high-quality cultivation of top-notch innovative talents were explained by this configuration, and about 1.6% of the cases were explained by this path. The representative university is Tongji University.

3.3. Reduction effects and substitution relationships of conditional variables

3.3.1. Reduction effects of funding input, discipline construction and faculty strength

By comparing Configuration 1a and Configuration 1b, both paths include four conditional variables including international cooperation, academic research, social services, and student quality. On this basis, Configuration 1a additionally passes through three conditional variables: funding input, discipline construction, and faculty strength. This indicates that when universities already possess strong international cooperation, academic research, social services, and student quality, the effects of funding input, discipline construction, and faculty strength on the cultivation of top-notch innovative talents can be reduced.

3.3.2. Substitution relationship between discipline construction and talent cultivation, international cooperation

By comparing Configuration 2a and Configuration 2b, it can be seen from **Figure 2** that both paths include three conditional variables: funding input, student quality, and faculty strength. On this basis, Configuration 2a additionally passes through the conditional variable discipline construction, while Configuration 2b passes through talent cultivation and international cooperation. This indicates that when universities possess strong funding input, student quality, and faculty strength, discipline construction and talent cultivation with international cooperation can act as substitutes.

3.3.3. Substitution relationship between international cooperation, student quality and talent cultivation, discipline construction, faculty strength

By comparing Configuration 1b and Configuration 3, it can be seen that both paths include two conditional variables, scientific research and social services. On this basis, Configuration 1b additionally passes through international cooperation and student quality, while Configuration 3 additionally passes through talent cultivation, discipline construction, and faculty strength. This indicates that when universities possess strong scientific research and social services, international cooperation and student quality can act as substitutes for talent cultivation, discipline construction, and faculty strength.