

support available to students. Finally, students' personal financial circumstances were equally strained, with 68.9% having less than ¥1,000 per month for total living expenses.

In summary, the research sample reflects the most prevalent category of economically disadvantaged students within China's higher vocational institutions: male students from rural, multi-child households, for whom vocational education represents the primary pathway to higher education. They typically pursue engineering disciplines, possess weak family economic foundations, and face severe constraints on personal living expenses. This establishes a robust foundation for subsequent research into the academic influencing factors affecting this cohort.

Table 1. Analysis of sample characteristics ($n = 61$)

Variable	Option	Frequency	Percentage
Gender	Male	55	90.2
	Female	6	9.8
Year	Second Year	61	100
Place of Origin	Urban	10	16.4
	Rural	51	83.6
Whether an only child	Yes	12	19.7
	No	49	80.3
Have you been recognised by your school as a student from a financially disadvantaged background?	Yes	61	100
Your family's primary source of income	Agriculture	18	29.5
	Parents working away from home	32	52.5
	Parents have stable local employment	2	3.3
	Parents without stable employment/unemployed	5	8.2
	Government subsistence allowance or social welfare	1	1.6
	Other	3	4.9
Your average monthly disposable income for living expenses (including food, transport, daily necessities, etc.) is approximately	£100 or less	42	68.9
	1,001–1,500 yuan	19	31.1

4.2. Analysis of key factors influencing the academic performance of students from economically disadvantaged families

The third section of the questionnaire examined four dimensions: financial pressure, academic engagement, psychological capital, and satisfaction with school support ^[1], thoroughly considering both internal factors and external environments influencing this student group's academic performance. Financial pressure primarily manifests as low household income and monthly living allowances, indirectly affecting academic engagement; academic engagement reflects students' vitality, effort, and focus on learning, resulting in different learning outcomes ^[2]; psychological capital indicates the mental state and social adaptation abilities of economically disadvantaged students; satisfaction with institutional support reveals this group's understanding of and contentment with the institution's financial aid policies, employment, and academic guidance. Specific analysis is

as follows.

4.2.1. Academic engagement

As shown in **Table 2**, a significant positive correlation exists between academic commitment and GPA ($r = 0.321$, $p < 0.05$). However, within the regression model (**Table 3**), academic commitment's independent predictive effect on GPA failed to reach statistical significance ($p = 0.074$). This outcome may stem from the small sample size, which may have prevented the capture of academic commitment's independent effect. Nevertheless, its standardised coefficient (Beta = 0.317) was the highest among all variables. This suggests that, for the specific cohort in this study, maintaining high levels of focus and effort in academic pursuits may represent a potential internal factor contributing to GPA variations, potentially outweighing the significance of external factors such as financial pressures.

Table 2. Correlation analysis results

	Financial Pressure	Study Commitment	Psychological Capital	Satisfaction with School Support	Last Semester GPA
Financial Pressure	1				
Academic Engagement	0.214	1			
Psychological Capital	0.106	0.643**	1		
Satisfaction with School Support	0.110	0.607**	0.677**	1	
Previous Semester GPA	-0.037	0.321*	0.259*	0.176	1

Table 3. Regression coefficient table

Model	Unstandardised Coefficient		Standardised Coefficient	t	Significance	Collinearity Statistics	
	B	Standard Error	Beta			Tolerance	VIF
(Constant)	2.015	0.566		3.564	0.001		
Economic pressure	-0.017	0.019	-0.109	-0.850	0.399	0.952	1.050
Learning Investment	0.020	0.011	0.317	1.818	0.074	0.514	1.947
Psychological Capital	0.018	0.025	0.128	0.692	0.492	0.456	2.195
Satisfaction with School Support	-0.009	0.019	-0.091	-0.512	0.610	0.491	2.036

a. Dependent variable: Previous semester GPA

4.2.2. Psychological capital

This study found that students' possession of positive psychological capital, such as self-efficacy beliefs, optimism, and confidence, may be crucial factors in helping them withstand economic pressures and maintain good academic performance. As shown in **Table 2**, psychological capital exhibits not only a significant positive correlation with academic performance ($r = 0.259$, $p < 0.05$) but also a highly positive correlation with learning commitment ($r = 0.643$, $p < 0.01$). This indicates that a positive mindset is likely to guide students towards actively engaging with their studies and investing greater energy in their learning. Consequently, these findings

suggest that the challenges posed by financial hardship extend beyond material constraints to encompass psychological dimensions. Robust psychological capital may assist students in effectively adjusting their mindset, adopting an optimistic approach to academic pursuits, and transforming external pressures into intrinsic motivation for learning.

4.2.3. Financial pressure

It is often assumed that greater financial pressure leads to poorer academic performance. However, this study found no data supporting a simple linear relationship between financial pressure and GPA. Analyses in **Table 2** and **Table 3** revealed that the correlation between financial pressure and GPA ($r = -0.037$, $p > 0.05$) and regression analysis ($p = 0.339$) both failed to demonstrate a significant direct impact of financial pressure on GPA. Nevertheless, this does not imply that financial pressure is inconsequential for GPA. Qualitative research from Part IV of the questionnaire indicates its impact is indirect and subtle. Students commonly reported needing to “devote substantial time to part-time work” and “frequently feeling anxious about living expenses,” suggesting financial pressure primarily disrupts studies by “consuming study time” and “draining energy.” This indirect mechanism finds support in the data. As shown in **Table 2**, financial pressure exhibits a positive correlation with academic engagement ($r = 0.214$). Though not statistically significant, this suggests that students under greater financial strain may devote more time to part-time work and related matters, thereby reducing their academic commitment. More significantly, financial pressure may exert an indirect effect through its potential depletion of psychological capital ($r = 0.106$). Thus, financial pressure does influence academic performance, but its impact is obscured by mediating variables such as “academic engagement” and “psychological capital.” This explains why it does not demonstrate an independent direct effect on GPA within the regression model.

4.2.4. Institutional support

This study also examined the factor of school support. According to **Table 2**, a direct association between students’ satisfaction with the support system (including financial aid, academic assistance, and career guidance) and their academic performance has not been fully established ($r = 0.176$, $p > 0.05$). Given the excellent reliability and validity of the measurement scale for this variable (Alpha = 0.953, KMO = 0.904), as demonstrated by the reliability and validity tests in **Table 4** and **Table 5**, the possibility of non-significant results due to measurement inaccuracy is excluded. This finding suggests that the existing school support system has room for improvement in precisely meeting students’ actual needs and translating these into interventions that enhance academic performance.

Table 4. Reliability analysis

Variable	Cronbach’s Alpha	Number of Items
Financial Pressure	0.791	5
Learning Investment	0.943	15
Psychological Capital	0.871	6
Satisfaction with School Support	0.953	7

Table 5. Validity analysis

Variable	KMO	Approximate chi-squared	Significance
Economic pressure	0.800	88.888	0.000
Academic Engagement	0.896	645.548	0.000
Psychological Capital	0.825	178.910	0.000
Satisfaction with School Support	0.904	463.904	0.000

5. Discussion

Based on the aforementioned data analysis and research, the author proposes several recommendations for academic support for college students from economically disadvantaged backgrounds.

Firstly, fully implement higher education funding policies to ensure comprehensive coverage for financially disadvantaged students. Currently, this higher vocational institution strictly adheres to the National Student Aid Centre's requirements, advancing financial assistance policies for all economically disadvantaged students across the institution to achieve all-encompassing educational support. Concurrently, by integrating national, institutional, and corporate scholarship and grant schemes, the college provides economic security for disadvantaged students ^[3]. However, addressing the frequent weekend part-time work undertaken by students to cover living expenses, the institution could offer diverse on-campus work-study positions, such as office assistants, library assistants, and canteen staff, enabling students to work conveniently alongside their studies.

Secondly, the level of effort and commitment to studies directly impacts academic performance. Educators should focus on students' future development by actively implementing targeted academic and career support measures. With the expansion of higher education and the universalisation of national financial aid policies, an increasing number of children from disadvantaged families are accessing tertiary education. Acquiring solid, practical professional skills and knowledge, and securing a satisfactory and respectable job, represent the primary educational objectives for many students from impoverished backgrounds. Firstly, academic and career guidance should commence from enrolment. Through class meetings and career planning sessions, students should be guided on structuring their college studies and professional development. This helps alleviate confusion and anxiety, fostering clear aspirations for both academic and career pursuits while revealing multiple pathways to achievement. For students with strong aspirations for further study, actively explain policies regarding undergraduate-to-postgraduate progression and postgraduate entrance examinations, alongside requirements and application pathways for state-sponsored overseas study programmes, thereby bolstering their resolve to pursue advanced qualifications. Regarding academic engagement, educators should enhance students' performance by assisting those facing financial hardship to refine study methods, improve learning efficiency, and increase their sense of academic achievement. This may include organizing study sharing sessions and academic exchange meetings featuring high-achieving peers. For students from disadvantaged backgrounds with strong post-graduation employment aspirations, guidance should be tailored to their professional development and future career goals. This includes advising on vocational certification requirements, recommending relevant internships, providing support for career planning competitions, and facilitating participation in job fairs. Such measures cultivate career planning awareness and a proactive approach to employment, thereby enhancing their competitiveness in the job market.

Finally, dual-track support through psychological assistance and life-view education should propel

the academic growth of economically disadvantaged students, fostering their holistic development through humanistic care. This study reveals that positive psychological capital enables students to approach their studies with optimism, thereby achieving academic progress. However, the open-ended responses in the questionnaire indicate that many students from economically disadvantaged backgrounds face significant psychological challenges. These include feelings of inferiority and anxiety stemming from financial hardship, guilt over prioritizing part-time work over studies, a sense of financial strain, and resignation towards their circumstances ^[4].

Educators should tailor interventions to the psychological characteristics of this group, offering targeted support to cultivate optimistic and proactive mindsets. This involves helping them adopt noble worldviews, outlooks on life, and values in their interactions with others, thereby strengthening their ideals and convictions to serve society. Organizing diverse practical activities for economically disadvantaged students, such as charitable initiatives in impoverished mountainous regions, community eldercare, or environmental conservation projects, can stimulate their social service awareness and nurture a commitment to giving back to society. Concurrently, implement one-to-one counselling, group psychological support sessions, or leverage peer-to-peer psychological guidance to alleviate negative emotions, bolster self-confidence, and promote mental wellbeing.

Disclosure statement

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Effective Paths of Employment and Entrepreneurship Education for College Students

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Abstract: With the continuous deepening of quality education, in addition to carrying out basic teaching tasks, colleges and universities should actively conduct employment and entrepreneurship education to promote students' all-round development. To achieve this educational goal, teachers should abandon traditional concepts, adopt advanced ideas, and innovate employment and entrepreneurship education focusing on core literacy. Specifically, teachers should try to integrate employment and entrepreneurship education into multiple teaching links such as student management and curriculum teaching, aiming to achieve the expected educational results and ultimately transport innovative talents with employment advantages and entrepreneurial capabilities for social construction in the new era. This paper focuses on the education of college students regarding employment and entrepreneurship, which plays a crucial role in students' subsequent development and the sustainable development of colleges and universities. Therefore, it is necessary to propose specific employment and entrepreneurship education paths that are tailored to students' actual learning situations and the development strategies of colleges and universities.

Keywords: College students; Employment and entrepreneurship; Education; Effective paths

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1. Introduction

The National Video and Telephone Conference on Employment and Entrepreneurship Work for Graduates of Ordinary Institutions of Higher Education held in May 2022 clearly stated that it is necessary to strengthen employment services for college students, and encourage students to start businesses through measures such as social security subsidies, entrepreneurial loans, and tax reductions and exemptions to promote graduates to integrate into the employment and entrepreneurship market as soon as possible. For this reason, college leaders and teachers need to actively carry out employment and entrepreneurship education, including constructing and improving the employment and entrepreneurship education system, and promoting the natural penetration of employment and entrepreneurship education in the entire teaching process. This can not only promote students' subsequent career choice and entrepreneurship but also drive regional economic development and

promote national development ^[1]. Specifically, under the guidelines and policies proposed by the Ministry of Human Resources and Social Security, colleges and universities should actively contact various departments to fulfill their responsibilities and exert their effectiveness, and form an educational synergy through cooperation, exchange, and consultation to ultimately achieve the expected educational results. How to further propose practical paths to promote college students' employment and entrepreneurship is one of the important issues that college leaders and teachers urgently need to solve. This paper will conduct an in-depth exploration around this issue, hoping to be beneficial to educators.

2. Practical significance of employment and entrepreneurship education for college students

2.1. Enhance students' employment competitiveness

Facing the increasingly fierce competitive environment, many students who are about to enter society feel confused about their future. Employment and entrepreneurship education are particularly important at this time. By providing personalized career planning and professional employment guidance, it helps students clarify their career direction, understand market demand, and thus formulate more practical career plans ^[2]. This kind of education not only focuses on the imparting of theoretical knowledge but also emphasizes the cultivation of practical ability. By organizing students to participate in internships, practical training, social practice, and other activities, students can improve their professional skills and accumulate work experience in practical operations, laying a solid foundation for future employment. It stimulates their entrepreneurial willingness and increases the possibility of self-employment. Under the guidance of employment and entrepreneurship education, students will have a clearer understanding of their strengths and weaknesses, and improve their abilities in a targeted manner, so as to stand out in the fierce job market and achieve smooth employment.

2.2. Cultivate students' innovative and entrepreneurial spirit

An innovative and entrepreneurial spirit is one of the important requirements for talent in modern society. College students' employment and entrepreneurship education stimulates students' innovative thinking and entrepreneurial awareness, improves their ability to discover, analyze, and creatively solve problems, as well as their practical ability to transform innovative ideas into actual results or commercial value ^[3,4]. In innovative and entrepreneurial education, students will be exposed to various innovative thinking methods and entrepreneurial cases, understand the basic knowledge and skills of innovation and entrepreneurship, and stimulate their willingness and interest in innovation and entrepreneurship. At the same time, entrepreneurship education will also provide students with opportunities for entrepreneurial practice, allowing them to continuously try, fail, and summarize in practice, thereby cultivating their perseverance and courage to face challenges. This spirit is not only of great significance to students' personal growth but also plays a positive role in promoting national and social development ^[5]. A society full of innovative and entrepreneurial spirit will continuously generate new ideas and concepts, promoting social progress.

2.3. Promote economic and social development

College students' employment and entrepreneurship education plays an important role in promoting economic and social development. First, by improving college students' employment competitiveness, it reduces social unemployment and helps maintain social stability. When a large number of college students can be employed

smoothly, the overall stability of society will be enhanced, and social problems caused by unemployment will be reduced ^[6]. Second, entrepreneurship education can cultivate a large number of innovative and entrepreneurial talents, inject new vitality and creativity into society, and promote sustained economic development. These innovative and entrepreneurial talents will continuously launch new products and services to meet the diverse needs of the market and promote the upgrading and optimization of the industrial structure. At the same time, their innovative and entrepreneurial activities can also drive the development of related industries, create more employment opportunities, and form a virtuous cycle. Third, as an important base for talent training, colleges and universities can provide strong talent support for economic and social development by strengthening employment and entrepreneurship education. These talents with innovative and entrepreneurial spirit and ability will become an important force for promoting social progress and contribute to the prosperity and strength of the country.

3. Current situation analysis of employment and entrepreneurship education for college students

3.1. Outdated educational concepts

Through the efforts of various colleges and universities in recent years, college employment and innovative teaching have achieved remarkable results. However, in the actual implementation of some colleges and universities, due to many restrictive factors, the teaching effect is difficult to meet expectations. The reason for this situation is related to outdated teaching concepts and teaching models ^[7,8]. Specifically, individual teachers in colleges and universities have an unclear understanding of employment and innovation education, and habitually confuse entrepreneurship education with vocational education, so that the value of employment and innovation education cannot be reflected. In addition, college teachers lack patience and carefulness in designing employment and innovation education activities, which weakens students' learning enthusiasm and fails to achieve the expected results. Moreover, when many colleges and universities carry out employment and innovation education, they simply combine it with professional courses but do not offer relevant courses in combination with the characteristics of innovation and entrepreneurship, resulting in insufficient systematicness and professionalism of employment and innovation education in colleges and universities.

3.2. Vague educational goals

Colleges and universities in various regions of China have different development histories, school-running characteristics, and strategic directions, which are also reflected in employment and entrepreneurship education ^[9,10]. For example, some colleges and universities do not pay enough attention to employment and entrepreneurship education and have not formulated educational goals suitable for actual educational development. In addition, although some colleges and universities have incorporated employment and entrepreneurship education into teaching tasks, the formulated educational goals lack integration with students' actual situations, and the set educational goals are inconsistent with teaching positioning, thus failing to highlight school-running characteristics and teaching advantages ^[11]. The employment and entrepreneurship education goals formulated by some colleges and universities are consistent with curriculum teaching goals, but they have not adjusted the employment and entrepreneurship education goals in combination with industry development trends, resulting in the lack of pertinence and forward-looking of educational goals, and ultimately leading to insignificant results of employment and entrepreneurship education.

3.3. Mechanical and single educational methods

In the process of carrying out employment and entrepreneurship education for college students, the mechanical and single educational methods have become an important problem hindering the innovation of employment and entrepreneurship education. Specifically, in the process of carrying out employment and entrepreneurship education, teachers are still used to adopting traditional methods and relying on traditional models, that is, the model of teachers lecturing and students listening. This one-way output teaching method is likely to lead to a lack of interaction in the classroom, and ultimately fail to effectively stimulate students' learning interest and motivation ^[12,13]. In addition, the single educational method adopted by teachers is also likely to make the educational content simple and outdated. Generally speaking, employment and entrepreneurship education involves a wide range of content, including career planning, entrepreneurial skills, market analysis and other aspects, which need to be fully covered by various teaching methods and means. However, the single educational method adopted by teachers makes the teaching content only stay on the surface.

4. Practical paths of employment and entrepreneurship education for college students

4.1. Improve the attention to employment and entrepreneurship education

When exploring the practical paths of employment and entrepreneurship education for college students, improving attention to employment and entrepreneurship education is a crucial link. On the one hand, as leaders and implementers of school education, leaders and teachers must maintain sensitivity and attention to employment and entrepreneurship-related information. This means they need to regularly browse and collect news and information closely related to employment and entrepreneurship, such as industry trends, enterprise recruitment needs, and market development trends ^[14]. At the same time, they also need to conduct an in-depth interpretation of various preferential policies issued by the government, such as entrepreneurial support funds, tax reductions and exemptions, and loan support, to timely convey this favorable information to students. In this way, students can understand the latest employment and entrepreneurship trends for the first time, providing strong support for their future career planning. On the other hand, curriculum teachers and managers need to update teaching concepts and management thinking, and integrate employment and entrepreneurship education into professional teaching. In terms of employment and entrepreneurship education, we should pay more attention to cultivating students' practical ability, innovative thinking, and team cooperation ability. Therefore, curriculum teachers need to intersperse cases, projects, and practical experience related to employment and entrepreneurship in the teaching process, guiding students to learn from practice and think about problems ^[15]. At the same time, managers also need to formulate corresponding management systems and incentive mechanisms to encourage teachers and students to actively participate in employment and entrepreneurship education activities, forming a good atmosphere of full participation and comprehensive education.

4.2. Strengthen the construction of employment and entrepreneurship courses

Teachers need to fully recognize the important role of constructing a curriculum system related to employment and entrepreneurship, and explore its construction path on this basis, to provide a scope and direction for teachers to carry out employment and entrepreneurship education. Through the implementation of curriculum teaching, effectively cultivate students' innovative awareness, improve their professional skills, enrich their entrepreneurial experience, and ultimately promote students' employment development. To improve the construction of the employment and entrepreneurship curriculum system, college leaders and teachers need to integrate internal

and external teaching resources and conduct overall planning and goal adjustment. After roughly constructing the framework of the employment and entrepreneurship curriculum system, colleges and universities should also take effective measures to improve and refine the content of employment and entrepreneurship courses, and extend and expand them to various majors and different fields, aiming to improve the systematicness and comprehensiveness of employment and entrepreneurship education. Generally speaking, the employment and entrepreneurship curriculum system established by colleges and universities includes basic courses, professional courses, practical courses, and entrepreneurial projects. In particular, teachers need to integrate professional core courses with employment and entrepreneurship education to set up employment and entrepreneurship courses in line with professional characteristics. At the same time, they also need to cooperate with enterprises, institutions, and the government to provide entrepreneurial platforms and resources.

Finally, they can target to improve and optimize the curriculum system around cultivating students' innovative awareness and improving their employment ability, and ultimately improve teaching content and select teaching methods. In addition, teachers need to introduce entrepreneurial cases and employment experiences that meet the syllabus, and can also show students relevant enterprise recruitment information, government preferential policies, and guidelines and policies, to expand their cognitive scope, enrich their knowledge system, improve their values, and ultimately effectively promote their all-round development.

4.3. Broaden the practical channels of employment and entrepreneurship education

First, teachers should adjust talent training tasks and improve teaching plans in combination with the development trends and strategies of colleges and universities, focusing on carrying out employment and entrepreneurship education. In addition to theoretical knowledge explanation, they should focus on organizing practical activities to exercise students' practical skills. One of the key points is that teachers should conduct a comprehensive analysis of the feasibility, implementability and professionalism of the employment and entrepreneurship education plan, providing reference and guidance for teachers to carry out practical activities in the future.

Then, teachers can organize students to conduct in-depth investigations and analysis around the topic of employment and entrepreneurship, guide them to analyze the current situation and causes of employment and entrepreneurship, and then simply predict the development trends of emerging industries in the future, to improve the quality of employment and entrepreneurship education. In addition, teachers can also organize students to experience and investigate front-line and grassroots areas, so that they can grasp the latest entrepreneurial trends and dynamics, and the matters needing attention in employment and entrepreneurship, laying a foundation for them to avoid risks in subsequent employment and entrepreneurship.

Finally, colleges and universities should also cooperate with enterprises to establish training and internship bases and jointly establish entrepreneurial bases, such as developing new software, establishing internship bases and innovation and entrepreneurship incubators. In addition, colleges and universities should also cooperate with local excellent enterprises, government departments and other institutions to jointly build practical entrepreneurial platforms, fully reflecting the main position of enterprises in this process, so as to provide students with practical platforms and opportunities for employment and entrepreneurship, ultimately achieve good practical teaching results, and continuously strengthen students' innovative thinking and entrepreneurial ability.

5. Conclusion

In summary, to adapt to the development trend of modern education and teaching, college leaders and teachers

need to carry out employment and entrepreneurship education based on quality education. They need to actively explore novel and effective teaching methods, such as improving the attention to employment and entrepreneurship education, strengthening the construction of employment and entrepreneurship courses, broadening the practical channels of employment and entrepreneurship education, and creating a cultural atmosphere for employment and entrepreneurship education, to cultivate high-quality talents with strong innovative awareness and entrepreneurial ability. This lays a solid foundation for them to adapt to social life and carry out entrepreneurship smoothly, and also injects new vitality into social development and national construction.

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Reform of the Evaluation Model for Higher Vocational Physics Courses Based on Modular Teaching

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Abstract: The deepening of higher vocational education reform has been progressing steadily, and the talent cultivation model centered on vocational capabilities has become increasingly mature. As an important basic course for science and engineering majors in higher vocational colleges, college physics plays a foundational role in cultivating technical talents. However, its traditional unitary and summative evaluation model of “one exam determining success” can hardly meet the needs of cultivating high-quality technical and skilled talents. By reconstructing the content of college physics courses and based on the modular teaching model, this paper analyzes the main problems existing in the current evaluation of higher vocational college physics courses, and constructs a diversified “trinity” evaluation system integrating process evaluation, outcome evaluation, and value-added evaluation. This system emphasizes the diversification of evaluation subjects, the comprehensiveness of evaluation content, and the variety of evaluation methods, and has been applied in teaching practice in a higher vocational college. The practical results show that this system can effectively stimulate students’ learning initiative, promote the coordinated development of their physical knowledge, practical skills, professional literacy, and innovative capabilities, and has positive significance for improving the quality of talent cultivation in higher vocational education.

Keywords: Higher vocational education; Modular teaching; College physics; Trinity; Diversified evaluation; Teaching reform

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1. Introduction

China’s higher vocational education aims to cultivate high-quality technical and skilled talents who meet the needs of the modern industrial system. The National Vocational Education Reform Implementation Plan (“20 Vocational Education Articles”) clearly points out that vocational education should “transform from following the general education school-running model to a type of education with enterprise and social participation and distinct professional characteristics”, and “strive to cultivate high-quality workers and technical and skilled

talents”^[1]. This series of policies determines that higher vocational education must be closely connected with the needs of professional positions, with the formation of students’ vocational capabilities as the core goal. As a basic course for engineering majors, the teaching goal of college physics not only requires students to proficiently master classical physics theories but also, more importantly, to cultivate students’ practical abilities such as transforming mechanical, electromagnetic, and other theoretical principles into equipment operation, process optimization, and technical fault diagnosis^[2].

However, the current physics course evaluation in many higher vocational colleges still generally adopts the method of final closed-book exams^[3]. This single evaluation model has many drawbacks:

First, it emphasizes knowledge over abilities. Higher vocational students are more inclined to intuitive thinking and practical interests. The traditional “lecture-learning-practice” cramming teaching method cannot mobilize students’ subjective initiative in learning. Evaluating higher vocational students’ college physics learning solely through final exam results cannot effectively measure key vocational abilities, such as students’ practical operation, problem-solving, and teamwork^[3].

Second, it emphasizes results over processes. Higher vocational education has a diverse source of students, including single-admission students, college entrance examination students, and retired soldiers, leading to significant differences in students’ learning abilities^[4]. The existing evaluation model ignores students’ efforts, progress, and individual differences in the learning process.

Third, the evaluation subject is single. Teachers are the only evaluators. Although students’ course scores are not subject to teachers’ will, there is a lack of students’ self-reflection and peer evaluation, not to mention the participation of industry and enterprises. This evaluation model cannot mobilize students’ learning enthusiasm, and to a certain extent, will suppress students’ subjective initiative, which is contrary to the talent cultivation goal of higher vocational education^[5]. Therefore, based on the single evaluation model, this paper reconstructs the content of higher vocational college physics courses. Taking the aircraft electromechanical equipment maintenance major as an example, the course content is divided into two major modules: mechanics and electromagnetism. On this basis, the course content is subdivided to construct a diversified evaluation system based on modular teaching, taking this as a breakthrough to reconstruct the evaluation model of higher vocational college physics courses, forcing the reform of the teaching model, and thus realizing the transformation of physical theories into practical abilities.

2. Connotation of modular teaching and diversified evaluation

2.1. Modular teaching

The essence of modular teaching is a competency-based and learner-oriented teaching model. In this curriculum reform, we define its core concept as: breaking the traditional knowledge system of college physics based on disciplinary logic, and reconstructing the course content into several relatively independent yet organically connected “teaching modules” according to the talent cultivation goals of higher vocational majors and students’ subsequent development needs^[6]. Specifically, each module is a complete learning unit, including clear learning objectives, selected teaching content, supporting teaching activities, and targeted evaluation plans^[7]. In this study, the course is designed into three levels: “basic theory module,” “professional technology application module,” and “expansion and innovation module” (**Figure 1**). Among them, the “basic theory module” ensures that students master the necessary basic physical knowledge; the “professional technology application module” is deeply integrated with different professional directions (such as electromechanical, aircraft maintenance, aircraft

manufacturing, etc.), selecting thematic content such as mechanics and machinery, electromagnetism and circuits, highlighting the practical application of physical principles in engineering technology; the “expansion and innovation module” focuses on scientific frontiers, physics history, or daily physics, aiming to cultivate students’ scientific literacy and innovative awareness. Through this modular reconstruction, the course has achieved a transformation from “knowledge infusion” to “ability cultivation” and from “disciplinary closure” to “professional openness,” laying a solid foundation for the implementation of diversified evaluation ^[6].

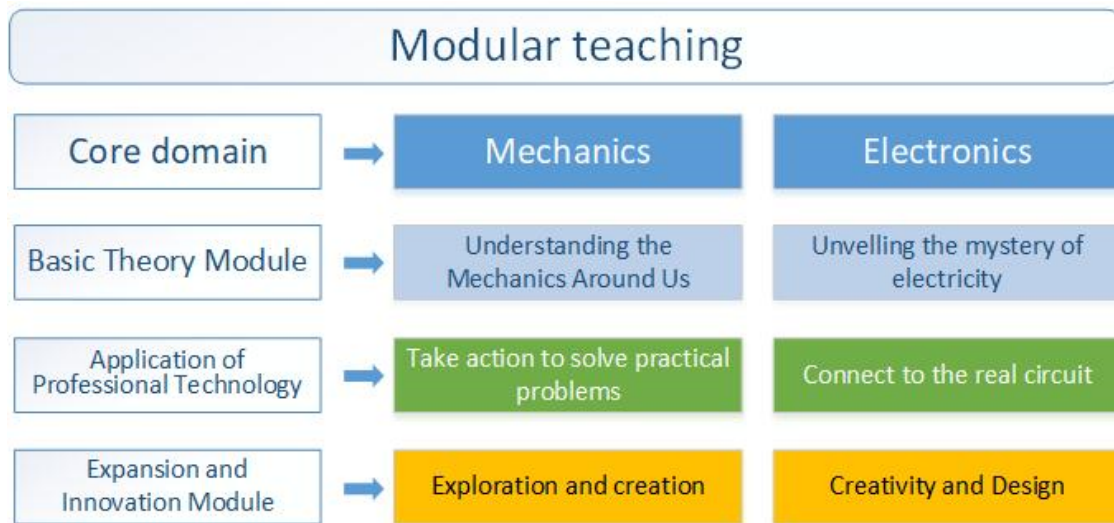


Figure 1. Display of the modular teaching content framework.

2.2. Diversified evaluation

According to the connotation of modular teaching, this study proposes the concept of diversified evaluation. Diversified evaluation refers to the innovation of the traditional single evaluation model, with its core lying in “diversification”, that is, diversified evaluation objectives, diversified evaluation content, diversified evaluation subjects, diversified evaluation methods, and diversified evaluation processes ^[8] (**Figure 2**).

Among them, diversified evaluation objectives mean shifting from simply examining the mastery of physical knowledge to a comprehensive evaluation of multiple dimensions such as knowledge understanding, skill application, scientific literacy, innovative thinking, and professional attitude.

Diversified evaluation content covers theoretical learning, experimental operation, project practice, classroom performance, extracurricular expansion, and other aspects.

Diversified evaluation subjects mean constructing a multi-subject evaluation network combining teacher evaluation, student self-evaluation, group mutual evaluation, and enterprise mentor evaluation (such as participating in project review).

Diversified evaluation methods mean comprehensively using various methods such as tests, experimental reports, project works, oral defenses, observation records, and portfolio evaluation.

Diversified evaluation processes mean integrating evaluation throughout the entire teaching process, realizing the organic combination of diagnostic evaluation, formative evaluation, and summative evaluation ^[8].

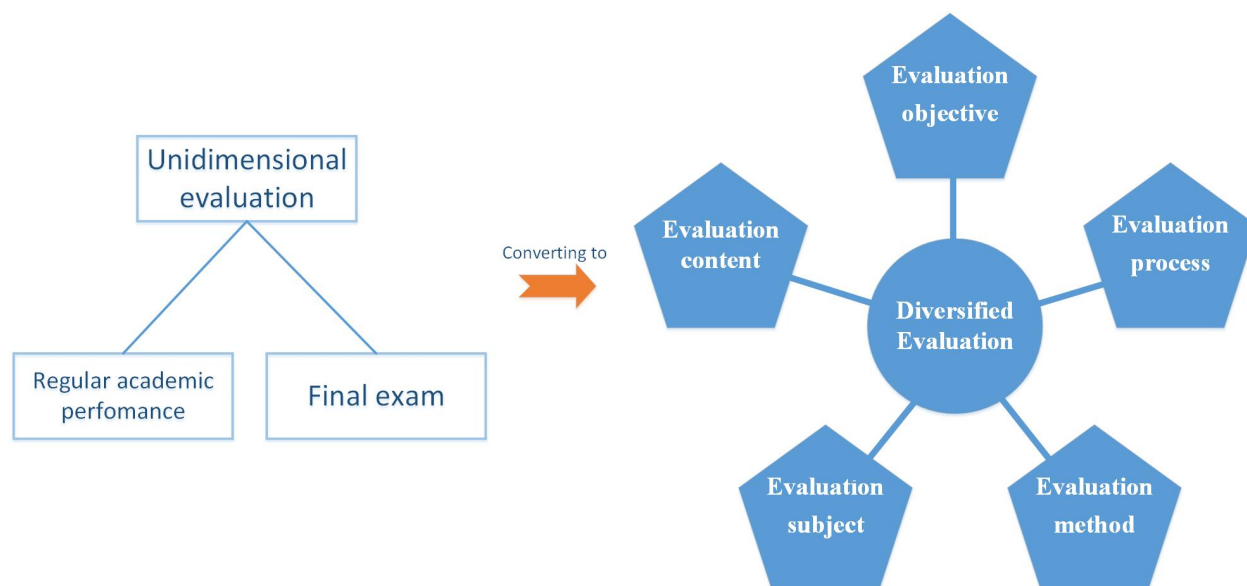


Figure 2. Comparison chart of diversified evaluation.

3. Construction of the “Trinity” diversified evaluation system

Based on the above concepts, taking the content of the college physics course learned by the electromechanical maintenance major in the Aircraft Maintenance College of Sichuan Southwest Aviation Vocational College as an example, we construct the following “trinity” diversified evaluation system model (**Figure 3**), with specific components as follows:

3.1. Process evaluation: Focusing on growth and habits

Process evaluation aims to provide timely feedback on students’ learning status, enable teachers to perceive the key and difficult problems encountered by students in learning, solve them promptly, and provide improvement ideas for subsequent course teaching to continuously optimize teaching quality^[9].

Process evaluation accounts for 40% of the entire evaluation system, among which pre-class preparation accounts for 10%, including the learning of pre-class video knowledge and the completion of pre-class knowledge tests. The Superstar Learning Platform is used to record students’ learning status. Quality achievements account for 10%, including teamwork, safety knowledge, craftsmanship spirit, information literacy, innovative awareness and ability, etc.^[10–12], evaluated by teachers, intra-group mutual evaluation, and student self-evaluation. In-class skill learning accounts for 20%. The Superstar Learning Platform is used to record chapter tests, online discussions, etc., to realize the timely consolidation and diagnosis of knowledge points. In this diversified evaluation system, process evaluation occupies a dominant position, and the evaluation focus shifts from participation in answering questions in class to pre-class preview, teamwork, data analysis ability, and the quality of completing group assignments.

3.2. Value-added evaluation: Encouraging innovation and individuality

Value-added evaluation accounts for 30%, aiming to respect students’ individual differences and encourage potential development and innovative spirit^[13,14]. Due to the wide range of students in higher vocational colleges, including single-admission students, college entrance examination students, and retired soldiers, the students’

foundations are uneven. Therefore, the focus of value-added evaluation is to include students' progress in the course learning process into the evaluation, thereby solving the evaluation contradiction caused by different learning foundations.

Among them, we innovatively incorporate physical innovation works and learning portfolios ^[15]. Physical innovation works refer to encouraging students to create small physical inventions, write popular science essays or research reports, and those who complete them can get extra points. Learning portfolios refer to students independently collecting key materials that can represent their learning process and progress (such as the best experimental reports, project plans, reflection logs, etc.) ^[16], which are displayed and summarized at the end of the semester as a reference for evaluation.

3.3. Outcome evaluation: Focusing on application and output

Outcome evaluation accounts for 30%, paying more attention to the assessment of students' phased and final learning outcomes ^[17]. However, different from the previous traditional final exams, we decompose outcome evaluation into modular project tasks and final written exams. Among them, modular project tasks account for 20%, designing physics application projects related to the major, or designing a small physical experiment to verify a physical principle. It is completed in groups, and project reports are submitted and defended, with comprehensive scores given by teachers and group mutual evaluation. The final comprehensive exam accounts for 10%. The content of the written exam is reformed, greatly reducing memory-based and computational questions, and increasing principle application questions, phenomenon analysis questions, case analysis questions, combined with the major, etc., focusing on examining the ability of knowledge transfer and solving practical problems.

Evaluation Process	Process Evaluation (40%)			Value-Added Evaluation (30%)				Outcome Evaluation (30%)								
	Pre-class (10%)			In-class (50%)				Post-class (20%)					Final Assessment (20%)			
Outcome Type	Knowledge Outcome (5%)		Skill Outcome (5%)	Quality Outcome (10%)				In-class Skills + Post-class Consolidation (60%)					Knowledge Outcome (10%)		Skill Outcome (10%)	
Evaluation Method	Self-study Before Class (10%)			Quality Outcome Evaluation (10%)				Mechanics Module(20%)		Electronics Module(20%)		Professional Literacy (20%)		Post-class test (5%)	Final exam (theory + practice) (5%)	Final outcome report (10%)
	Pre-class video knowledge learning (5%)	Pre-class knowledge test completion (5%)		Teamwork (2%)	Safety awareness (2%)	Craftsmanship spirit (2%)	Information literacy (2%)	Innovation awareness & ability (2%)	Knowledge evaluation: Class discussion, post-class assignment completion (10%)	Skill evaluation: Project practice (e.g., simple mechanical device design/assembly, maintenance skill training) (10%)	Knowledge evaluation: Case analysis of household circuits, phased test of electrical knowledge (10%)	Skill evaluation: Project practice (electrical training project development) (10%)	1. Safety standard awareness: Correct & safe use of experimental equipment.2. Team collaboration awareness: Teamwork in group tasks.3. Innovation ability: Optimized mechanical structure/ circuit design.		Post-class test	Final exam: Questions combining college physics theory & practice (5%)
Evaluation Subject	Teacher evaluation			Teacher evaluation, intra-group peer review, student self-evaluation				Teacher evaluation, intra-group peer review, training teacher review, student self-evaluation					Teacher evaluation		Teacher evaluation, intra-group peer review	

Figure 3. “Trinity” diversified evaluation system model.

4. Teaching practice and effect analysis

This study conducted a one-semester practice in two parallel classes of the 2024-level electromechanical maintenance major in the Aircraft Maintenance College of Sichuan Southwest Aviation Vocational College. Among them, Class A (60 students) adopted the traditional evaluation model of “50% usual performance + 50% final exam,” and Class B (58 students) implemented the above-mentioned diversified evaluation system.

4.1. Practice process

In the teaching of Class B, relying on the Superstar online teaching platform, we implemented the following processes:

- (1) Pre-class: Issue task lists and micro-course videos, and students complete online preview and tests (process evaluation records).
- (2) In-class: Carry out group discussions and inquiry activities, and teachers observe and record (process evaluation). Introduce enterprise cases for analysis.
- (3) Post-class: Complete online assignments and finish a professional-related project task in groups (outcome evaluation).
- (4) End of semester: Conduct comprehensive written exams (outcome evaluation) and organize learning portfolio sorting (value-added evaluation).

4.2. Effect analysis

Through questionnaire surveys, score comparisons, and teacher-student interviews at the end of the semester, the following findings were obtained:

- (1) Score comparison: There was no significant difference in the average score of the final written exam between Class B and Class A, but Class B performed significantly better than Class A in links reflecting comprehensive abilities, such as project defense and experimental reports. The excellent rate and pass rate of the overall evaluation score of Class B were higher than those of Class A.
- (2) Learning interest and attitude: The questionnaire showed that more than 85% of the students in Class B believed that diversified evaluation could better stimulate learning interest, make themselves pay more attention to daily learning and practice processes, and the distribution of learning pressure was more balanced.
- (3) Self-evaluation of ability improvement: The self-evaluation scores of students in Class B in terms of “problem-solving ability,” “teamwork ability,” “expression ability,” and “innovative thinking” were significantly higher than those in Class A.
- (4) Teacher feedback: The teachers believed that although diversified evaluation increased the initial workload, it could help them understand each student more comprehensively and in-depth, making teaching more targeted. The classroom atmosphere and students’ participation were significantly improved.

5. Discussion

Practice has proved that the diversified evaluation system based on modular teaching has effectively reversed the tendency of “only focusing on scores”, transforming evaluation from a “sieve” into a “pump,” which fulfilling the functions of motivation, diagnosis, and development, and promotes the coordinated development of students’ knowledge, abilities, and literacy. However, there are also some challenges in the practice process: first, it puts forward higher requirements for teachers, who need to invest a lot of energy in designing evaluation standards, organizing activities, and recording data; second, how to design project tasks more closely combined with different majors requires the in-depth participation of professional teachers and enterprise personnel; third, the quantification and fairness of diversified evaluation need to be further refined.

In the future, we will deepen the research into the following aspects:

- (1) Develop a diversified evaluation management tool deeply integrated with the information-based teaching platform to reduce teachers' workload and realize the automatic collection and analysis of evaluation data.
- (2) Strengthen school-enterprise cooperation, invite enterprise engineers to participate in the design and evaluation of project tasks, and introduce more realistic professional standards.
- (3) Explore the integration of vocational skill level standards in the "1+X" certificate system into physics course evaluation to further enhance the professionalism and authority of evaluation.

6. Conclusion

Constructing a diversified evaluation system for higher vocational college physics based on modular teaching is an inevitable requirement for adapting to the development of vocational education as a type of education. Through the diversification of evaluation objectives, content, subjects, and methods, this system integrates evaluation throughout the entire teaching process, realizing the transformation from "valuing knowledge over ability" to "integrating knowledge and practice." Teaching practice shows that this system can effectively improve students' comprehensive vocational abilities and learning sense of gain, and has important promotion value for deepening the reform of higher vocational physics teaching and improving the quality of technical and skilled talent cultivation.

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The authors declare no conflict of interest.

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Practical Research on Realizing Developmental Financial Assistance Through One-Stop Student Communities

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Abstract: Against the background of the high-quality development of higher education in the new era, university financial assistance work is transforming from “guarantee-oriented” to “development-oriented,” emphasizing the integration of economic support and talent cultivation, and improving students’ comprehensive quality and sustainable development capabilities. As an innovative carrier for talent cultivation, the “one-stop” student community, with the advantages of being close to students’ lives and integrating resources, provides an ideal platform for developmental financial assistance. The two are highly consistent in philosophy: the former focuses on ability growth and potential stimulation, while the latter realizes the sinking of education through spatial reconstruction and service integration. In practice, through multi-departmental linkage, a four-dimensional service system, and digital intelligence support, an integrated model of “assistance-service-development” has been constructed, effectively realizing the transformation from “blood transfusion” to “blood production,” and providing a practical paradigm for universities’ “all-staff, whole-process, and all-round education.”

Keywords: Developmental financial assistance; One-stop student community; Practical path; Effect

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1. Introduction

Under the background of higher education reform in the new era, the educational environment of universities presents new characteristics: students’ growth backgrounds, values, and needs are becoming increasingly diverse and personalized. Students from economically disadvantaged families^[1] not only need economic assistance but also yearn for comprehensive support such as ability improvement, psychological care, and career planning; at the same time, the goal of university education focuses on students’ all-round development, emphasizing the cultivation of socialist builders and successors with all-round development of morality, intelligence, physical fitness, aesthetics, and labor^[2], which puts forward innovative requirements for traditional educational ideas and methods.

As the transformation direction of university financial assistance work, developmental financial assistance breaks through the limitations of traditional “guarantee-oriented” assistance. Li (2019)^[3] pointed out that developmental financial assistance constructs a five-in-one developmental financial assistance and education system, including economic assistance, psychological counseling, spiritual support, academic guidance, and ability improvement through a three-dimensional model of “economic assistance + ability building + value guidance”, closely combining assistance with education and promoting students’ all-round development. At the same time, as an innovative carrier for talent cultivation, the “one-stop” student community provides an ideal platform for developmental financial assistance with the advantages of being close to students’ lives and integrating resources. Chen (2023)^[4] believes that the “one-stop” student community has become a practice field for “all-staff, whole-process, and all-round education” and an important institutional and mechanism innovation to strengthen university’s backbone and ideological and political work.

Currently, the synergistic effect between the two has not been fully exerted, with problems such as scattered resources and imperfect mechanisms. Ma (2025)^[5] proposed that the “one-stop” student community builds a comprehensive platform covering ideological education, Party and League activities, teacher-student interaction, cultural exchange, and life services by gathering forces from the government, universities, society, and students. Exploring the path of assistance and education in this context is of great significance. The core of the synergy between the two lies in resource integration and scenario integration: developmental financial assistance provides targeted assistance objects for community services, and the “one-stop” community provides daily scenarios for assistance and education, jointly building a closed-loop education chain of “identification-assistance-development-feedback.” In addition, Gao (2024)^[6] emphasized that digital intelligent technology can optimize the identification of assistance objects and demand matching, providing technical support for collaborative education. Therefore, in-depth research on the internal logic, practical paths, and innovative models of collaborative education between the two has both theoretical value and practical guiding significance, and can provide new ideas for optimizing the university education system.

2. Connotation and characteristics of developmental financial assistance in the new era

2.1. Connotation of developmental financial assistance

Developmental financial assistance and education is the core model of the transformation of university financial assistance work from “guarantee-oriented” to “development-oriented” in the new era, and its connotation can be defined from two aspects: goal upgrading and practical paths.

First, core positioning: Kuang (2024)^[7] believes that on the basis of ensuring the basic living needs of students from economically disadvantaged families, taking “education” as the fundamental goal, through integrating resources and building platforms, it promotes students’ transformation from “passive assistance” to “active development”, and ultimately realizes the in-depth integration of economic support, ability improvement, and value shaping.

Second, practical logic: breaking through the limitations of traditional single economic assistance, combining economic assistance with multiple educational elements such as academic guidance, career planning, psychological support, and social practice^[8]; adhering to the concept of “helping people to help themselves,” guiding students to participate in practical activities such as employment and entrepreneurship, academic research, and public welfare services through mechanisms such as “community-university linkage” and “family-school collaboration,” cultivating independent development capabilities and social responsibility; the ultimate

goal is to promote the comprehensive improvement of students' political quality, moral literacy, knowledge and skills, and physical and mental quality, helping them realize socialization and individualization transformation and grow into high-quality talents adapting to social needs.

2.2. Characteristics of developmental financial assistance

2.2.1. Development orientation: From “Short-Term Guarantee” to “Long-Term Empowerment”

Developmental financial assistance takes students' lifelong development as the core goal. It not only solves the current economic difficulties but also focuses on cultivating independent learning, self-management, and innovative practice capabilities through continuous support (such as academic tutoring, scientific and technological innovation training, and professional quality training), comprehensively helping students, ensuring that on the basis of economic assistance, students can obtain motivation and resources for continuous development.

2.2.2. Diversified integration: Resource integration and full-element coverage

Developmental financial assistance not only integrates multiple forms such as economic assistance (scholarships, grants, student loans), academic support (course tutoring, skill training), psychological services (emotional counseling, stress resistance training), and career development (job hunting guidance, internship connection) to form a three-dimensional support system of “material + spirit + ability”^[9]; but also links internal and external resources (enterprises, communities, families) to build an educational platform to meet students' multi-dimensional needs in academics, psychology, social interaction, and career^[10]. This diversified integration not only improves the pertinence and effectiveness of assistance but also provides a solid guarantee for students' all-round development.

2.2.3. Subject participation: Stimulating students' subjective initiative

Developmental financial assistance encourages students to transform from “passive recipients” to “active participants,” enhancing self-efficacy and sense of responsibility by establishing student autonomous organizations, participating in the design of assistance projects, and leading public welfare activities; it emphasizes “practical education” more, guiding students to exercise their abilities in activities such as employment and entrepreneurship, academic research, and voluntary services, and establishing the values of “self-reliance, self-improvement, gratitude, and dedication”^[11]. This subject participation not only enhances students' self-efficacy but also cultivates their sense of responsibility and teamwork spirit, laying a solid foundation for their future social adaptability.

2.2.4. Educational nature: In-depth integration of assistance and education

Developmental financial assistance breaks the positioning of a “pure economic tool,” transforming assistance work into an important carrier for value shaping. Through inspirational education, integrity education, and gratitude education, it helps students establish correct outlooks on life, worldviews, and values; taking “developmental financial assistance” as a link, it realizes the combination of “management and education, inspiration and ability enhancement, learning and practice,” and ultimately achieves the educational effect of “assisting one person, growing one person, and driving a group.”

3. Logical framework of realizing developmental financial assistance through one-stop student communities

3.1. Goal level: Value alignment, education-oriented

Both developmental financial assistance and the “one-stop” student community follow the fundamental principle of “fostering morality and cultivating people”, surpassing the single attribute of “economic guarantee” of traditional assistance and the basic function of “affair management” of the community, and jointly pointing to the comprehensive development of students’ “knowledge, ability, and quality”^[11].

3.2. Service level: Scenario integration, resource aggregation

At the service logic level, developmental financial assistance and the “one-stop” student community form in-depth scenario integration based on student demand orientation. The service objects of the two highly overlap, both focusing on student groups with prominent growth needs (such as assisted high-care students and students in need of help in ideology, psychology, and academics), avoiding resource mismatch; the goal of the improved assistance and education system to meet diverse needs through platforms, personnel, and resources is naturally consistent with the comprehensive and sustainable service scenarios already built by the “one-stop” community^[12]. The community can directly carry out functions such as assistance policy promotion and personalized assistance, providing a convenient and efficient carrier for assistance services. Assisted students not only become the biggest beneficiaries through in-depth participation in community activities but also provide feedback on the vitality of community governance, forming a virtuous closed loop of “service-participation-benefit.”

3.3. Content level: Element complementation, connotation interconnection

Developmental financial assistance is based on “scholarships, loans, grants, and work-study” economic assistance, extending to development dimensions such as ideological and moral education, academic tutoring, psychological counseling, and skill improvement; the “one-stop” community focuses on growth affairs such as ideological guidance, affair handling, career planning, and employment guidance^[13], and the two highly overlap in core contents such as academic assistance, psychological services, and career development.

3.4. Mechanism level: Collaborative linkage, efficient operation

Developmental financial assistance emphasizes resource integration and a four-dimensional mechanism of “material-morality-ability-spirit”, and the “one-stop” community adheres to backbone leadership, gathers educational forces, and establishes a normalized interaction mechanism. The two are highly consistent in governance structure (Party committee leadership, departmental collaboration, college implementation), process management, dynamic adjustment, and other concepts and principles.

4. Practical paths of realizing developmental financial assistance through one-stop student communities

4.1. Mechanism construction: Focusing on “Assistance +” to strengthen collaborative guarantee

4.1.1. Establish a “Assistance +” collaborative management mechanism

Construct a leading group for assistance and education in the “one-stop” community, clarify the powers and responsibilities of the Student Affairs Department, Community Management Office, secondary colleges, and teacher Party branches, incorporate assistance effects into community construction assessment, and form a three-

level responsibility chain of “leadership coordination-departmental linkage-branch implementation.” Implement a “paired assistance” system, through the model of “1 backbone connecting 1–2 assisted students,” carry out academic tutoring, ideological counseling, and life care relying on community scenarios, realizing the in-depth integration of backbone leadership and precise assistance^[14].

4.1.2. Improve the “Multi-Departmental Linkage” communication and coordination mechanism

Build a cross-departmental information sharing platform, integrate the assistance management system, community service system, and student behavior big data module, dynamically update assistance status, activity participation, and feedback data, providing support for precise demand identification. Establish a “biweekly joint meeting” system, with representatives from assistance departments, community counselors, and professional teachers participating, regularly assessing needs and adjusting strategies, forming a closed-loop management mechanism of “demand-feedback-optimization.”

4.2. Resource integration: Focusing on “Four-Dimensional Integration” to activate educational elements

Centered on four-dimensional resources of “material assistance-academic support-psychological counseling-employment assistance”, construct a collaborative development system of “financial support + ability improvement”. Set up a “growth empowerment workstation” in the “one-stop” community, form a professional team of full-time teachers, psychological counselors, and career planners, and provide personalized guidance through a mechanism of “demand diagnosis-scheme customization-tracking feedback”^[14]. Innovate project-based operation, connecting traditional policies such as scholarships, loans, grants, and work-study with developmental resources such as scientific research training, social practice, and skill improvement classes, forming a two-way model of “economic bottom-line guarantee + ability value-added support,” promoting the transformation of assistance resources from “single material supply” to “diversified growth empowerment”, and improving the pertinence and effectiveness of education.

4.3. Activity design: Centering on “Four Aspects of Education” to create characteristic educational scenarios

Based on the four-dimensional educational framework of “moral edification-ability development-spiritual motivation-digital empowerment,” construct a characteristic activity system adapted to the goals of developmental financial assistance, realizing the organic unity of “assistance” and “education” through scenario-based design.

4.3.1. Focus on “Moral Edification” to strengthen value guidance

Focusing on gratitude education, integrity education, and family and country feelings cultivation, relying on positions such as community activity rooms and red cultural corridors, carry out activities such as “assistance policy promotion meetings,” “integrity-themed debates,” and “red classic reading clubs,” guiding assisted students to establish the values of “knowing gratitude, being grateful, and repaying kindness,” and integrating personal development into national strategic needs.

4.3.2. Focus on “Ability Development” to improve comprehensive quality

Design modular activities such as “academic gas stations,” “career launch plans,” and “sunshine heart

stations” around three dimensions of academic improvement, career development, and psychological quality, systematically improving students’ core competitiveness through a training path of “theoretical learning-practical exercise-feedback iteration.”

4.3.3. Focus on “Spiritual Motivation” to cultivate responsibility

Through activities such as “inspirational figures entering the campus” and “growth sharing meetings of assisted students”, explore typical cases of outstanding assisted students and give play to the demonstration role of role models; organize students to participate in public welfare projects such as community voluntary services and rural revitalization social practice, guiding them to enhance self-confidence, sense of responsibility, and sense of mission in serving others and contributing to society.

4.3.4. Focus on “Digital Empowerment” to optimize educational efficiency

Using technical means such as big data and artificial intelligence, develop a “student development portrait system” to dynamically track the participation, academic performance, and psychological status of assisted students in community activities; rely on the community smart service platform to push personalized activity recommendations, realizing the precise supply of assistance services and the intelligent management of the educational process.

4.4. Digital intelligence support: Creating a new ecology of “Smart Community + Precise Assistance”

Centered on “data-driven and intelligent empowerment”, relying on the digital platform of the “one-stop” student community, construct a new educational ecology of in-depth integration of “smart community” and “precise assistance”, realizing the paradigm transformation of assistance services from “experience judgment” to “data decision-making” ^[15]. Integrate multi-source heterogeneous data such as community activity check-in records, online learning platform duration, and consumption behavior trajectories, and use machine learning algorithms to construct behavioral characteristic portraits of assisted students. By setting thresholds for key behavioral indicators, it automatically identifies assistance needs and strengthens the forward-looking and precision of assistance and education.

5. Summary

Relying on the “one-stop” student community, developmental financial assistance has realized the transformation from economic assistance to comprehensive education. Through backbone leadership, resource integration, activity innovation, and digital intelligence support, an integrated model of “assistance-service-development” has been constructed, promoting students from “receiving assistance” to “helping themselves,” effectively improving the effectiveness of assistance and education, and helping universities achieve the goal of “all-staff, whole-process, and all-round education.”

Disclosure statement

The authors declare no conflict of interest.

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Problems and Countermeasures in Practical Teaching of Legal Major in Vocational Colleges

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Abstract: Practical teaching of the legal major in vocational colleges is crucial. In the new era, it is necessary to promote modernization and digitalization, respond to the call for craftsmanship spirit and moral education in vocational colleges, which is of great significance for the future development of vocational college students. However, in the corresponding work, it is not difficult to find problems such as the marginalized status of practical teaching, the disconnection between teaching content and reality, and the lack of vocational characteristics. As front-line teachers, we should actively adjust and optimize teaching strategies, and propose countermeasures for current prominent problems. Therefore, combined with the current situation of legal majors in vocational colleges, as well as new concepts and technologies, this paper puts forward several feasible and effective development strategies, hoping to provide more references for front-line educators.

Keywords: Vocational colleges; Legal major; Practical teaching; Problems; Countermeasures

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1. Problems existing in the practical teaching of legal major in vocational colleges

1.1. Marginalized status of practical teaching

Vocational colleges attach great importance to the practical teaching module itself, but there are multiple deviations in the practice of the legal major. On the one hand, most schools adopt the form of moot court teaching on campus, with limited activities and supporting resources, leading to the marginalization of practice^[1]. On the other hand, the development and application of off-campus training platforms are insufficient. Opportunities for professional internships, graduation internships, and court observations are limited, which are not enough to provide comprehensive training support for all students, inevitably resulting in efficiency and quality problems, and further hindering the development of practical teaching. In addition, no vocational college has fully issued systematic requirements on objectives, content, procedures, and assessment for the legal major, making the practical teaching module a mere formality, which requires profound reflection from front-line teachers.

1.2. Disconnection between practical teaching content and job requirements

Combined with teaching practice, it is obvious that the practical teaching content of the legal major is

disconnected from job requirements. According to relevant data, less than 20% of graduates from the legal major in vocational colleges have entered the judicial system in recent years ^[2,3]. In other words, although vocational colleges seemingly attach great importance to the practical teaching of the legal major, the overall efficiency and quality are reduced due to factors such as poor content connection and single and rigid methods, resulting in poor contributions to the legal profession and the judicial system. Of course, our understanding of judicial practice is also limited, ignoring many non-judicial departments of legal services, which is also a major path for accepting graduates from legal majors in vocational colleges. Such mismatched educational positioning is also one of the important factors causing employment difficulties for graduates from the legal major in vocational colleges.

1.3. Lack of “Vocational” characteristics in practical teaching

Practical teaching lacks its own characteristics and is prone to being led astray in the initial stage of imitation, resulting in serious homogenization and a lack of characteristics. Vocational colleges have not been running legal education for a long time, and the curriculum setting, content, and method design are still in the primary stage, making such problems prone to occur. Some schools still imitate and compress the teaching system of ordinary undergraduate colleges without their own complete disciplinary system, which will naturally lead to serious homogenization and lack of characteristics ^[4]. If a complete teaching objective system, syllabus, evaluation mechanism, and training platform cannot be explored and formed in the future, the overall quality level will inevitably be reduced, restricting the innovative development of legal practical education, which requires us to pay attention, reflect deeply, and improve gradually.

1.4. Incomplete collaborative education mechanism of integration of theory and practice

The coordination between theoretical and practical teaching of legal major in vocational colleges is poor, and various advanced resources have not been effectively integrated and utilized, resulting in an underdeveloped integration mechanism. Collaborative innovation is a value criterion based on integration, cooperation, integration, and sharing for colleges and universities to improve the overall quality of talent training. However, it is obviously not developing smoothly in the practical education of vocational colleges, and the exploration of practical teaching of the legal major is still in the primary stage. Most colleges and universities lack a sense of coordination, leading to different value orientations and criteria among teachers, students, the government, and enterprises. Over time, internal resources cannot be fully utilized, and the role of external collaborative education is difficult to play, which limits the innovative development of legal education ^[5]. In the future, it is necessary to explore the collaborative education mechanism of integration of legal theory and practice to fundamentally improve the problems and enhance the level of education.

2. Improvement strategies for practical teaching problems of legal major in vocational colleges

2.1. Strengthen top-level design and construct a systematic, practical teaching system

To fundamentally reverse the marginalization of the practical teaching of legal major in vocational colleges, systematic reconstruction must be carried out at the institutional level. At present, most colleges and universities lack unified practical teaching standards and implementation paths, leading to strong randomness in teaching and uneven quality. Therefore, it is urgent for provincial competent departments of education to take the lead, jointly with judicial administrative departments, industry associations, and representative vocational colleges,

to formulate the Guidelines for Practical Teaching of Legal Majors in Vocational Colleges, clarifying practical objectives, content modules, class hour ratio, assessment methods, and resource guarantee requirements at each stage^[6-8]. On this basis, each school should refine its talent training plan in combination with regional legal construction needs and the main employment directions of graduates, integrating practical teaching throughout the three-year academic system: the first year focuses on legal cognition and basic skill training; the second year focuses on simulated training and post experience; the third year strengthens real post internships and comprehensive ability output. At the same time, a special practical teaching management office should be set up to coordinate internal and external resources, establish a dynamic feedback mechanism, and regularly evaluate practical effects and optimize teaching design. Only through institutionalized, standardized, and whole-process top-level design can practical teaching move from “dispensable” to “indispensable,” and truly become the core pillar of legal vocational education.

2.2. Deepen the integration of production and education and build a diversified and collaborative practical education community

The key to solving the disconnection between practical teaching content and job requirements lies in breaking the barrier between the education chain and the industrial chain, and building a collaborative education mechanism involving the government, industry, enterprises, and schools. Vocational colleges should take the initiative to connect with local judicial bureaus, law firms, arbitration commissions, notary offices, small and medium-sized enterprises, and grass-roots governance units to jointly build a “legal practice collaborative education platform.” On the one hand, implement the “double tutors + project-based” training model: on-campus teachers are responsible for theoretical guidance and process management, while off-campus practical experts undertake real case analysis, skill demonstration, and achievement evaluation, and jointly develop practical projects close to posts such as “labor dispute mediation training packages” and “small and medium-sized enterprise compliance review task sheets.” On the other hand, expand the types and functions of internship bases, covering not only traditional judicial organs but also emerging scenarios such as public legal service centers, township comprehensive governance centers, and industrial park legal service stations, providing students with diverse and real practical opportunities^[9-11]. In addition, explore in-depth cooperation forms such as “order-based classes” and “modern apprenticeship system,” such as jointly setting up “legal assistant directional training classes” with local well-known law firms, realizing curriculum co-construction, teacher sharing, assessment co-evaluation, and employment co-promotion. At the same time, build a “virtual + real” integrated training environment with digital technology, making up for the lack of offline resources through VR simulated court trials and intelligent legal consultation systems. By building a collaborative ecology of resource sharing, responsibility sharing, and achievement co-creation, practical teaching can truly respond to industry needs and serve regional development.

2.3. Highlight vocational attributes and construct a differentiated and characteristic practical teaching model

Legal education in vocational colleges must get rid of the path dependence on legal education in ordinary undergraduate colleges, and build a practical teaching system with distinct vocational characteristics based on the positioning of “application-oriented and skill-oriented”. First, in terms of curriculum setting, the proportion of pure theoretical courses should be greatly reduced, and practical courses with distinct vocational orientation such as Non-litigation Legal Practice, Grassroots Legal Service Skills, Enterprise Compliance Operation Practice, and Community Conflict Mediation Technology, should be added, focusing on cultivating students’

ability to solve specific problems in real work scenarios^[12]. Second, promote the integrated model of “task-driven - scenario simulation - achievement output” in teaching methods, such as organizing students to carry out “legal physical examination” services in communities, providing legal consultation on marriage and inheritance, property disputes, etc. for residents, and forming standardized service reports; or cooperating with local small and medium-sized enterprises to guide students to complete real tasks such as labor contract review and compliance assessment of rules and regulations. Furthermore, pay attention to the integration of “law + digital technology,” introduce emerging skill training such as electronic evidence preservation, online mediation platform operation, and intelligent case recommendation, and improve students’ professional literacy to adapt to the era of smart justice. Finally, abandon single written examination assessment in the evaluation system, adopt process portfolio evaluation, and take the quality of legal opinions, customer satisfaction, mediation success rate, and project completion degree as core indicators^[13]. Only by adhering to “teaching based on posts and training based on abilities” can we form an irreplaceable school-running characteristic and enhance the competitiveness of graduates in the grassroots legal service market.

2.4. Promote the integration of theory and practice and realize the in-depth integration of teaching processes and resources

To solve the long-standing problem of “two skins” between theory and practice, it is necessary to promote the systematic integration of teaching concepts, content, processes, and evaluation, and build a truly integrated education mechanism of theory and practice. Vocational colleges should break the traditional fragmented model of “first theoretical teaching, then centralized internship” and implement “embedded circular teaching.” Specifically, set up several practical units in each professional core course: synchronize contract drafting and review training with Civil Law Principles, supporting administrative penalty hearing simulation with Administrative Law Practice, and conducting evidence analysis exercises combined with real case files with Criminal Procedure Law, realizing a virtuous cycle of “learning for application and application promoting learning”. At the same time, develop cross-curriculum comprehensive training projects, such as “one-stop legal service full-process training”, covering complete links including client reception, case analysis, legal research, document production, mediation and negotiation, or litigation preparation, to cultivate students’ systematic thinking and comprehensive practice ability. Gradually break down the barriers between academic affairs, training centers, student affairs, employment and other departments, and uniformly plan teaching progress, teacher allocation, and venue use. Strengthen the construction of “double-qualified” teachers, and improve teaching coordination through teachers’ on-the-job training in practical departments, practical experts entering the classroom, and joint teaching and research^[14,15]. Regularly collect employers’ evaluations of students’ practical abilities, and reversely optimize curriculum content and teaching methods. Only through mechanism innovation and process reengineering can we realize the resonance and mutual promotion of theoretical teaching and practical training, and comprehensively improve the educational effect of legal vocational education.

2.5. Improve quality evaluation to ensure the continuous optimization of legal practical teaching modules

For practical teaching to achieve high-quality and sustainable development, it is necessary to establish a scientific, dynamic, and diversified quality evaluation system and supporting incentive mechanism. At present, vocational colleges generally have the problem of “emphasizing form over effect”, which stems from the lack of effective process monitoring and result feedback mechanisms. Therefore, a “goal - process - achievement” trinity practical

teaching quality evaluation model should be constructed: at the goal level, set quantifiable practical goals according to professional teaching standards and post ability maps; at the process level, track the implementation through multi-dimensional data such as teaching logs, guidance records, student reflection reports, and enterprise tutor evaluations; at the achievement level, not only focus on internship reports or simulation performance but also introduce real service effect indicators, such as the adoption rate of legal consultation, the performance rate of mediation agreements, and the completion degree of enterprise compliance rectification. At the same time, the evaluation subjects should be diversified, including on-campus teachers, off-campus tutors, service objects, and student self-evaluation, to ensure an objective and comprehensive evaluation. On this basis, establish an incentive and accountability mechanism linked to evaluation results: give preference to teachers with outstanding practical teaching effects in professional title evaluation, performance assessment, and project application; award the title of “Demonstration Base for Collaborative Education” and policy support to enterprises or institutions with close cooperation and remarkable educational effects; for students, include practical achievements into the credit bank, comprehensive quality evaluation, and even employment recommendation system. In addition, it regularly releases the Annual Report on the Quality of Legal Professional Practical Teaching, disclosing key indicators and improvement suggestions. With this complete institutionalized quality assurance and positive incentive, stimulate the internal motivation of all parties to participate in practical teaching, promote it from “passive completion” to “active innovation”, and realize continuous iteration and high-quality development.

3. Conclusion

In summary, the reform of the practical teaching of legal major in vocational colleges is an inevitable trend in development. It is necessary to focus on problems in content, methods, characteristics, and mechanism systems, and formulate corresponding improvement plans. We emphasize the educational value of practical teaching and its positive impact on students’ career development. Therefore, it is hoped that through teaching reform in the future, a collaborative education mechanism suitable for the legal practice and long-term career development of vocational college students can be constructed. It is hoped to contribute to the reform of practical teaching of legal major and meet the evolving professional needs related to law.

Disclosure statement

The author declares no conflict of interest.

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A Case Study of Teachers' Translanguaging in College English Classrooms at Xizang University

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Abstract: In recent years, translanguaging as a pedagogical method has gained both consensus and divergent perspectives. However, studies focusing on the translanguaging of College English teachers in China's ethnic minority regions remain relatively scarce. This study employs qualitative methods, including classroom video observations and post-video stimulated recall interviews, to analyze the translanguaging of teachers in College English classrooms at Xizang University. The findings reveal that teachers primarily utilize three types of translanguaging resources, respectively, linguistic, embodied and semiotic resources. The purposes for employing these resources can be categorized as supporting language acquisition, diagnosing and adapting to students' learning needs, activating classroom interaction, optimizing teaching efficiency, transmitting cultural meanings, and fostering literacy development.

Keywords: Teachers' translanguaging; College English classrooms; Xizang University

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1. Introduction

As an important component of China's higher education system, the College English course bears the dual mission of serving national strategic needs and promoting students' personal development^[1]. At present, there are problems in English teaching in Chinese universities, such as tight class hours, traditional teaching methods, and the need to improve teaching effectiveness. There is an urgent need for continuous exploration and updating of teaching concepts and methods. Against this practical backdrop, bilingual or multilingual phenomena are common in College English classrooms in ethnic minority regions, and teachers frequently employ multimodal tools such as gestures, facial expressions, and multimedia. These practices require a rational theoretical interpretation and value reevaluation. Therefore, translanguaging theory provides a new theoretical lens, breaking away from rigid language separation. It posits that communicators, to achieve effective meaning negotiation, view target language learning as a process of integrating existing linguistic resources with new ones^[2]. This perspective provides a theoretical foundation for understanding the multisemiotic nature of College English classrooms, elevating teachers' flexible use of multimodal resources from mere teaching techniques to a

systematic pedagogical method. Thus, examining College English teachers' instructional behaviors through the lens of translanguaging holds significant practical and theoretical value.

2. Literature review

2.1. The development of translanguaging theory

The evolution of translanguaging theory reflects a profound shift in academic understanding of language and language teaching. Originating from a Welsh language revitalization project in the 1990s, Williams first used the term “trawsieithu” to describe the phenomenon of using two languages in the classroom ^[3]. Baker further conceptualized this as “translanguaging” and introduced it to academia, proposing the “unitary language repertoire” hypothesis, which challenges the traditional view of languages as independent systems ^[4]. García systematically developed Baker’s hypothesis, critiquing the ideology of “double monolingualism” from a sociolinguistic perspective and establishing language as a dynamic social practice ^[5]. Simultaneously, Li’s “translanguaging space theory” complemented this by emphasizing translanguaging as a social field for stimulating critical thinking and identity negotiation ^[6]. Subsequently, García and Li integrated these theoretical perspectives, clearly distinguishing translanguaging from code-switching and marking the initial formation of the theoretical framework ^[7]. Recent developments have further highlighted the inherent multimodal dimension of translanguaging. Li reconceptualized language as a communicative resource encompassing multisensory and multisemiotic elements ^[2]. This expansion not only responds to the multimodal realities of communication in the digital age but also provides a more comprehensive theoretical tool for analyzing complex semiotic interactions in educational settings. In light of the theoretical trajectory above, this study defines translanguaging as teachers’ pedagogical practices of integrating multiple resources by crossing boundaries of semiotic systems, languages, and modalities in foreign language classrooms.

2.2. Empirical research on translanguaging of foreign language teachers

Research on translanguaging has evolved from early descriptive accounts of multilingual phenomena to in-depth explorations of the complexities of teachers’ practices. For instance, initial studies primarily focused on how teachers strategically used multiple linguistic resources to facilitate content understanding in bilingual classrooms. Saputra and Atmowardoyo further conducted micro-level classifications of teachers’ translanguaging behaviors, identifying types such as inter-sentential, intra-sentential, insertion, congruent lexicalization, and entire translanguaging ^[8], thereby deepening the understanding of the diversity of translanguaging forms. Subsequently, the research focus shifted from form classification to functional analysis. For example, Cenoz and Gorter distinguished between “pedagogical” and “spontaneous” translanguaging ^[9], emphasizing the intentionality and situational adaptability of teachers’ practices. In recent years, the research scope has significantly broadened, systematically analyzing how teachers integrate multimodal resources such as gestures, postures, and digital tools to cross-cultural boundaries, facilitate knowledge comprehension, and achieve classroom inclusivity, thereby constructing more effective learning environments. Although relevant domestic research started relatively late, it has developed rapidly, achieving important progress in aspects such as internationalized teaching in higher education, content and language integrated learning (CLIL) classrooms, and translanguaging in English-medium instruction (EMI) contexts.

From what has been discussed above, there remain two major gaps in the existing research. Thematically, existing classifications of translanguaging resources remain broad and lack refinement, with minimal attention directed toward teachers’ translanguaging resource utilization in higher education within border regions. In addition, while EMI and CLIL classrooms have received considerable scholarly attention, College English,

a compulsory course for undergraduates in China that plays an indispensable role in cultivating students' comprehensive literacy, has been underexplored. Methodologically, few studies have integrated objective records of teachers' overt behaviors with their subjective intentions. Since post-video stimulated recall interview has been recognized as an effective means to bridge observable behaviors and internal reflections ^[10], its application in translanguaging research remains limited. Therefore, this study adopts a mixed-methods approach combining classroom video observations with post-video stimulated recall interviews. Focusing on College English teachers at Xizang University, it seeks to address the following two research questions:

- (1) What translanguaging resources are employed by teachers in College English classrooms?
- (2) What are the purposes behind teachers' use of translanguaging resources in College English classrooms?

3. Research design

3.1. Research context

This study is administered within the setting of the College English classrooms at Xizang University, where students are primarily divided into elementary-level classes and advanced-level classes according to their English subject scores of the College Entrance Examination (Gaokao). Different textbooks are applicable to each level. "New Horizon College English (Fourth Edition)" is adopted for advanced-level classes, while "New Generation English (Second Edition)" is utilized in elementary-level classes. The course schedule varies across semesters. In the first semester of the freshman year, classes are held twice per week, with each session lasting 90 minutes. In the second semester of the freshman year and the first semester of the sophomore year, classes are held once per week, with each session lasting 135 minutes.

3.2. Research participants

This study selected College English teachers from Xizang University as the research samples. As the only comprehensive university and the sole "double first-class" discipline construction university among the eight universities in Xizang Autonomous Region, Xizang University exhibits typical translanguaging within its College English classrooms based on findings from a pilot study. As a consequence, selecting Xizang University for investigating teachers' translanguaging in College English classrooms holds certain representativeness within the context of universities in border regions. After the identification of the research scope, a combination of purposive sampling and convenience sampling is employed to select eight participants (**Table 1**) in order to ensure both the rationality and feasibility of participant recruitment.

Table 1. Specific information of research participants

Research participants	Years of teaching experience	Class type	Observation duration (Minutes)	Interview duration (Minutes)	Transcription word count
T1	28	Freshman Elementary-level	135	39.45	15580
T2	7	Freshman Elementary-level	135	37.26	10347
T3	30	Sophomore Elementary-level	135	46.09	11303
T4	13	Sophomore Advanced-level	135	35.07	11076
T5	14	Sophomore Elementary-level	135	49.54	10501
T6	5	Freshman Advanced-level	135	44.26	10875
T7	14	Freshman Elementary-level	135	45.45	12219
T8	14	Freshman Advanced-level	135	57.02	12097

3.3. Data collection

Data collection for this study spanned five months and consisted of three phases: a pilot phase, an initial data collection phase, and a supplementary data collection phase. Two primary instruments were employed, respectively, classroom video recordings and post-video stimulated recall interviews. Non-participatory classroom observations were conducted to capture teachers' employment of translanguaging resources. Classroom sessions and subsequent interviews were recorded with the teachers' consent. During the pilot phase, three teachers were observed to gain a preliminary understanding of translanguaging in College English classrooms. In the phase of formal data collection, a total of 24 classroom video recordings and corresponding teacher interview audio recordings were obtained.

3.4. Data analysis

Data processing and analysis were conducted by applying ELAN 6.9 and Excel. To address the first research question, classroom segments were selected based on the diversity of translanguaging, the completeness of teaching procedures, and relevance to the research question. These segments were observed and annotated in ELAN 6.9 to annotate the use of translanguaging resources. The annotation scheme was based on the operational definition. An additional researcher specializing in English language teaching was invited to co-annotate a portion of the data to ensure reliability, achieving an inter-coder consistency rate of over 90%. Discrepancies in coding were resolved through discussion until consensus was reached. In terms of the second research question, thematic analysis was applied to the interview data ^[11]. The specific steps included transcribing and thoroughly reading the text, conducting line-by-line coding to extract significant excerpts, grouping codes to generate candidate themes, and reviewing these themes collaboratively with two other researchers while referring back to the data. This process resulted in an analytical framework comprising 6 main themes and 17 sub-themes. This framework was then adopted to explore the purposes of teachers for applying translanguaging resources, supported by illustrative excerpts from the interviews.

4. Results and discussion

4.1. Results and discussion from classroom video observation

This study quantified the translanguaging resources utilized by the eight teachers in College English classrooms (Table 2).

Table 2. Classification of translanguaging resources employed by teachers

Classification	Subclassification	T1	T2	T3	T4	T5	T6	T7	T8
Linguistic Resources	Chinese	√	√	√	√	√	√	√	√
	English	√	√	√	√	√	√	√	√
	Tibetan			√					
Embodied Resources	Gestures	√	√	√	√	√	√	√	√
	Positional Movements	√	√	√		√	√	√	√
	Facial Expressions	√	√	√	√	√	√	√	√
	Eye Contact	√	√	√	√	√	√	√	√
	Body Postures	√	√	√		√	√	√	√
	Head Motions	√	√	√	√	√	√	√	√
Semiotic Resources	Texts	√	√	√	√	√	√	√	√
	Pictures	√				√		√	
	Board Writing	√	√		√	√		√	√
	Videos		√		√	√		√	√
	Audio Materials		√					√	√

As shown in **Table 2**, the translanguaging resources employed by teachers in College English classrooms can be categorized into three main types, including linguistic resources, embodied resources, and semiotic resources. This classification framework aligns with some existing studies ^[12], but also diverges from others ^[8,9]. The discrepancy is potentially attributable to this study's specific focus on certain purposeful teachers' translanguaging within the College English classroom context.

Language, embodied behavior, and symbolic resources together constitute the resource system of teacher's translanguaging practice. The selection and integration of resources by teachers are conscious teaching designs based on learning situations, content, and goals, reflecting their multimodal literacy. These findings support the translanguaging theory's emphasis on the flexible deployment of semiotic resources ^[13] and resonate with multimodal communication theory ^[14], revealing the role of multimodal resources in facilitating comprehension, optimizing input, and enhancing interaction. Therefore, translanguaging in the College English classrooms can be viewed as an effective teaching strategy. This study suggests that teacher professional development should prioritize cultivating teachers' translanguaging competence, the ability to identify, design, and integrate diverse semiotic resources to better navigate the complex and dynamic realities of classroom teaching.

4.2. Discussion

Through thematic analysis of the interview data, this study identified six core purposes for teachers' use of translanguaging resources in College English classrooms. They are respectively supporting language acquisition, diagnosing and adapting to learning needs, activating classroom interaction, optimizing teaching efficiency, transmitting cultural meanings, and expanding literacy cultivation, collectively forming a systematic framework of pedagogical support.

4.2.1. Foundational support: Supporting language acquisition and adapting to learning needs

The primary purposes of using translanguaging resources are to provide crucial support for students' language acquisition and to enable dynamic adaptation based on real-time diagnosis of their learning needs. These two aspects form the foundation for effective teaching in College English classrooms. Support for language acquisition manifests as teachers using translanguaging resources to build scaffolds for students' understanding, thus reducing their cognitive load and facilitating their internalization of target language knowledge. However, effective support needs to be built upon accurate diagnosis of and adaptation to students' learning needs. Teachers must continuously diagnose students' learning backgrounds, proficiency levels, and real-time states, adjusting their teaching accordingly.

4.2.2. Process enhancement: Activating interaction and optimizing efficiency

Subsequent to establishing the teaching foundation, teachers further employ translanguaging resources to deepen the teaching process by activating classroom interaction and optimizing instructional efficiency. Activating classroom interaction refers to teachers using translanguaging resources to engage students' senses, mobilize their affect and cognition, and transform them from passive recipients into active participants, thereby fostering a highly engaged classroom dynamic. For example, T5 used sudden positional movement to disrupt students' expectations and refocus their attention, serving as an effective starting point for activating an interactive atmosphere ^[15]. Meanwhile, optimizing teaching efficiency involves teachers integrating translanguaging resources to reduce time consumption and cognitive load, thereby enhancing teaching effectiveness per unit of time.

4.2.3. Ultimate goal: Transmitting cultural meanings and fostering literacy development

The explicated purposes of using translanguaging resources are the transmission of cultural meanings and, ultimately, serving the cultivation and expansion of students' comprehensive literacy. Transmitting cultural meanings involves teachers in transforming the language classrooms into sites of cultural practice. T8 used video resources to guide students in comparing concepts of friendship across different cultures, thereby expanding the language classroom into a field for cultural practice. Ultimately, all these practices aim at students' broader literacy development. Meanwhile, T8 used video content to guide students in connecting the material to their own lives and reflecting on handling romantic relationships, achieving the transferable cultivation of social literacy. This phenomenon primarily indicates that translanguaging resources can both deepen language and cultural literacy internally and promote social and life literacy externally, collectively demonstrating their breadth and depth in whole-person education, echoing the goals of "comprehensive cultural literacy" and "whole-person education" outlined in "College English Curriculum Requirements (2020 edition)".

In summary, teachers' adoption of translanguaging resources reveals a hierarchical structure of purposes, progressing from "foundational support" to "process enhancement" and finally to "literacy development". The underlying logic is student-centered, constructing a coherent learning path from knowledge internalization to literacy development through the integrated adaptation of resources. Thus, translanguaging transcends being a mere teaching technique and emerges as a significant agentive strategy for teachers to achieve systematic instructional design within complex classroom contexts ^[7].

5. Conclusion

Focusing on College English teachers at Xizang University, this study systematically investigated the classification and purposes of their translanguaging. The findings reveal that teachers' translanguaging consists of linguistic, embodied and semiotic resources. Moreover, their employment demonstrates a clear hierarchy of purposes, extending from the foundational level of providing language acquisition support and adapting to students' learning needs, to the process level of activating classroom interaction and optimizing teaching efficiency, and ultimately aiming at the explicated goals of cultural transmission and literacy development. Theoretically, this study constructs a framework for translanguaging resources and reveals the systematic hierarchy of their purposes, deepening the understanding of translanguaging. Practically, it provides a reference for teachers to reflect upon and optimize their teaching, and suggests that teacher education should emphasize developing teachers' ability to integrate diverse translanguaging resources. However, this study has limitations, including a single source of participants, a limited observation period, and a lack of data from the student perspective. Future research could expand the sampling to different regions and incorporate students' achievement data and feedback to further explore the relationship between translanguaging and teaching effectiveness, thereby deepening the research on foreign language teachers' translanguaging in universities within ethnic minority regions.

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The authors declare no conflict of interest.

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Construction and Practice of AIGC-based Smart Teaching Mode for “File Operations” in Higher Vocational Linux Courses

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Abstract: Addressing the teaching pain points of the “file operation” module in the “Linux Network Operating System” course in higher vocational education, which involve abstract commands and students’ tendency to make mistakes during operations, this study constructs and practices a three-stage teaching model of “demonstration-imitation-application” empowered by AIGC, aiming to integrate it throughout the entire teaching process: before class, personalized preview materials are generated using AIGC to achieve precise “demonstration”; during class, interactive question-answering and standardized guidance are conducted relying on AIGC to support effective “imitation”; after class, comprehensive practical training tasks are dynamically generated through AIGC to promote knowledge transfer and “application”. Teaching practice shows that this model effectively improves students’ operational standardization and skill proficiency, enhances their ability to transfer knowledge and solve practical problems, and provides a reference path and practical case for the deep integration of AIGC technology and vocational education teaching.

Keywords: AIGC; Linux teaching; File operation; Personalized learning; Teaching mode innovation

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1. Introduction

With the rapid development of cloud computing, big data, and artificial intelligence technologies, the Linux network operating system, as its core cornerstone, plays an irreplaceable role in data centers, network operation and maintenance, software development, and other fields ^[1]. Higher vocational education aims to cultivate high-quality technical and skilled talents. Proficiently mastering Linux system management and operation has become a core professional competency for students majoring in computer network technology and related fields ^[2]. Therefore, how to efficiently conduct Linux course teaching and enhance students’ practical operation abilities has become an important issue in higher vocational computer education.

However, in traditional Linux course teaching practice, there are significant teaching difficulties in basic

modules such as “file operations”. Linux has numerous commands and abstract syntax, and its character interface operation method has a high threshold for students who are accustomed to graphical interfaces, which can easily lead to fear of difficulties^[3]. Students often make frequent errors during practice due to unclear parameter memory and improper path operation, while teachers find it difficult to provide immediate and personalized guidance for each student, resulting in delayed teaching feedback. In addition, the traditional model of “teacher demonstration student imitation” is difficult to stimulate learning initiative, and the singularity of cases also limits the cultivation of students’ knowledge transfer and problem-solving abilities.

In recent years, the rise of Artificial Intelligence Generated Content (AIGC) technology has provided new ideas for solving the aforementioned teaching difficulties. AIGC tools have powerful natural language understanding and content generation capabilities, enabling efficient human-machine natural interaction and real-time creation of contextualized content^[4]. In the practical process of this study, DeepSeek and other AIGC tools were used as the core intelligent assistance platform^[5] to explore their potential application in Linux teaching scenarios in vocational colleges. Introducing AIGC technology into the teaching process aims to free teachers from repetitive guidance work and provide students with continuous and accurate “intelligent teaching assistant” support.

2. Construction of the “Demonstration Imitation Application” teaching model assisted by AIGC

2.1. Structured process of teaching mode

To integrate AIGC technology into the entire teaching process^[6], this study constructed a “demonstration imitation application” teaching mode that runs through three stages: pre-class, in-class, and post-class (**Figure 1**). In the pre class stage, AIGC focuses on precise demonstrations and helps students establish a visual impression of operations by generating personalized preview materials; During the in class stage, emphasis is placed on

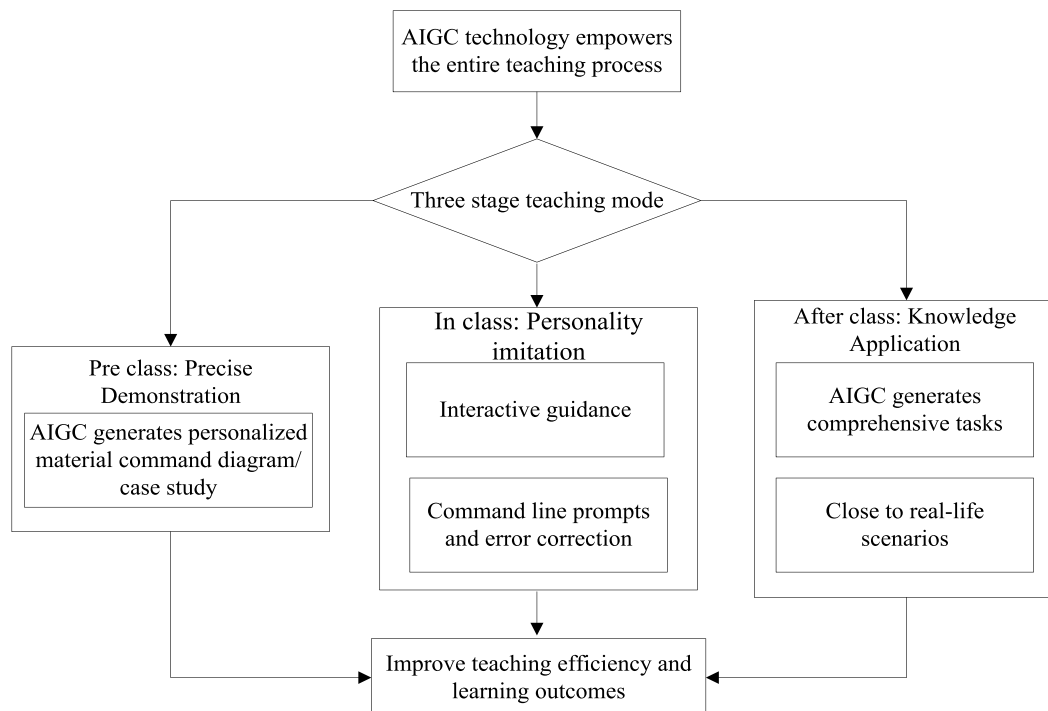


Figure 1. Overall operational process.

standardized imitation, and AIGC serves as an interactive guidance tool to guide students in mastering correct operations through real-time Q&A and error correction; In the post class stage, emphasis is placed on the application of knowledge, and AIGC promotes students to transform their learned knowledge into practical problem-solving skills by generating real-life tasks. This teaching model achieves an organic connection between various links through AIGC technology, forming a complete teaching loop from cognitive construction to ability development, significantly improving teaching efficiency and learning effectiveness.

2.2. Functional role empowerment of AIGC

The effective operation of this teaching mode is attributed to the collaborative empowerment of the three core roles undertaken by AIGC throughout the entire teaching process, as shown in **Figure 2**. As an intelligent generator of teaching resources, AIGC can quickly prepare personalized materials based on teaching objectives and learning data, achieving precise and efficient lesson preparation; As an interactive guide in the practical process, AIGC provides real-time feedback and error correction through natural language dialogue ^[7], ensuring the standardization and personalized support of students' operational training; As an effective promoter of comprehensive abilities, AIGC drives knowledge internalization and transfer by designing comprehensive tasks in real-life scenarios, cultivating students' engineering thinking and problem-solving skills. These three roles together constitute the core mechanism of AIGC empowering teaching.

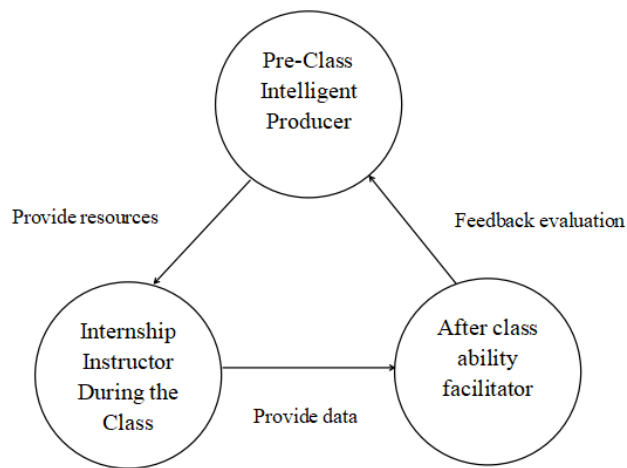


Figure 2. Core roles in AIGC teaching.

3. Specific application practice of AIGC in “File Operation” teaching

3.1. Pre-class: Automatic generation of personalized preview materials

In the pre-class preview stage, use AIGC tools to generate personalized preview materials for students of different foundations and levels, achieving the initial implementation of “teaching according to individual abilities.”

For students with zero foundation, AIGC can generate “story-based” preview cards and lower cognitive barriers through real-life metaphors. For example, comparing “files” to “notebooks”, “directories” to “folders,” using “create a new notebook” to explain the touch command, “copy notes” to explain the cp command, and “organize desktop” to explain the purpose of the mv and rm commands. This type of intuitive mapping effectively lowers the cognitive threshold, helps students establish a sensory understanding of command-line operations, and clears conceptual barriers for classroom learning.

For students who already have a foundation, AIGC will generate an exploratory task list to guide them to independently build their knowledge system through project practice. For example, design a project management task: create a project directory, use the touch command to create a draft.exe file, use the cp command to back up, create a soft link through ln, and use the find command to search for specific text files. This task-driven mode transforms traditional passive knowledge reception into an active exploration process, effectively stimulating students' interest in learning.

AIGC also provides efficient data generation support for teachers, allowing them to quickly create three types of practical preview materials: command comparison charts that visually display the differences in options for commands such as cp; Provide case studies and preventive measures for misoperation of high-risk commands such as rm using the Operation Safety Compass; scenario exercises are designed around common problem scenarios. These resources combine production efficiency with targeted teaching, laying a solid foundation for the smooth implementation of subsequent classroom teaching.

3.2. In-class: Interactive guidance and standardized training

In the practical session of the class, AIGC integrates into the learning environment through dialogue as an “intelligent teaching assistant”. If students encounter difficulties while operating commands such as touch, cp, mv, etc., they can ask AIGC questions in natural language at any time. The system generates targeted diagnostic feedback and step-by-step operational suggestions through semantic understanding, forming an interactive mechanism of “question and answer.” This method effectively avoids repeated trial and error caused by details errors, while improving operational efficiency and enhancing students' learning confidence ^[8].

To address the issue of difficulty in memorizing command options, the system supports interaction in natural language. For example, when students ask colloquial questions such as “how to copy the entire directory”, AIGC can accurately respond with specific command formats and explain the meaning of parameters. Part of the AIGC integrated terminal tools also provide command auto completion and parameter prompt functions, further reducing students' memory burden.

When completing comprehensive training tasks such as “log file management”, AIGC can guide students to operate step by step according to standardized processes, and cultivate their rigorous operational logic through standardized guidance. The system also pushes personalized exercise content based on students' actual performance: providing advanced challenge tasks for proficient operators, arranging targeted consolidation exercises for those with weak foundations, and achieving differentiated teaching.

For teachers, AIGC effectively undertakes repetitive guidance work, enabling them to focus on teaching organization and thinking guidance. By examining the interaction records between students and AIGC, teachers can accurately grasp common difficult problems and provide focused explanations in the classroom, thereby devoting more energy to heuristic teaching and personalized guidance, and improving teaching effectiveness.

3.3. After-class: Dynamic case design and knowledge transfer training

In the post-class stage, AIGC promotes knowledge transfer and ability expansion by generating comprehensive tasks of real-life scenarios. Taking “Server Log File Archiving Management” as an example, this task requires students to comprehensively use commands such as mkdir, cp, mv, rm, find, etc. to complete the classification, archiving, and cleaning of log files, effectively improving their knowledge integration and practical abilities.

Based on the interaction records between students and AIGC during class, the system can generate a “learning feedback report” that reflects their common errors and accurately identifies the problem. For example, in case

of improper use of the `chmod` command, the system will prompt “Suggest reviewing the differences between numerical and symbolic permission modes” and provide corresponding learning resources and improvement suggestions.

Based on students’ learning trajectories, AIGC will also intelligently push advanced content such as shell script writing and file permission management, to help students build a systematic knowledge system. At the same time, by designing project-based tasks such as “personal blog site construction,” students are guided to complete the entire process from directory creation to log maintenance, cultivating engineering thinking and problem-solving skills in real project practice, and achieving a leap from knowledge mastery to ability development.

4. Analysis of application effectiveness

To systematically evaluate the effectiveness of the teaching mode, this study conducted a DeepSeek-based teaching practice on 91 students majoring in computer network technology^[9]. Data was collected through skill tests, questionnaire surveys, and classroom observations, and the following analysis results were obtained.

In the process of teaching practice, the introduction of AIGC technology has brought significant teaching improvements to the “file operation” unit. Its innovative real-time interactive feature effectively improves students’ practice experience, and the system provides instant Q&A and error correction functions, building a virtuous learning cycle of “learning while doing and answering questions.” The course survey results show that the vast majority of students believe that this function significantly reduces the sense of frustration in the learning process, and this timely and effective support method has a significant promoting effect on maintaining students’ learning motivation and exploratory desire.

The application of AIGC has driven a profound change in teaching methods^[10]. By intelligently analyzing students’ questioning content, AIGC can accurately identify individual knowledge weaknesses and provide precise, targeted guidance. Teaching practice has shown that after systematic training, students have significantly improved in the standardization of command usage. Of particular note is that students with different levels of foundation can make effective progress on their respective foundations, fully reflecting the unique advantages of differentiated teaching.

Through carefully designed work scenario simulation tasks, AIGC effectively promotes the organic connection between skill learning and career application. In the process of completing a series of practical tasks, students not only consolidate their command operation skills, but more importantly, enhance their in-depth understanding of practical work logic. Student feedback indicates that this problem-oriented teaching approach significantly enhances their ability to transform abstract command knowledge into practical problem-solving skills.

AIGC has also significantly optimized the rational allocation of teaching resources. The intelligent guidance support provided by the system allows teachers to free themselves from repetitive Q&A and devote more energy to course design and in-depth analysis of key issues. Classroom observation records show that teachers have significantly increased their time spent on heuristic teaching and personalized guidance, and this shift in teaching focus has had a positive impact on improving overall teaching quality.

5. Conclusion

This study systematically integrates AIGC technology into Linux file operation teaching, and constructs an

intelligent teaching mode that runs through pre-class, in-class, and post-class. Practice has proven that this model has achieved significant results in improving teaching efficiency, regulating operational behavior, and promoting knowledge transfer, providing a valuable path for vocational education curriculum reform.

There are still some limitations to this study: the accuracy and adaptability of AIGC in handling complex operational scenarios need to be improved; The balance between intelligent assistance and students' independent thinking ability needs further exploration; In addition, the dependence of teaching mode on technological facilities also limits its promotion to a certain extent.

Future research will focus on exploring implementation plans in low-tech environments, deepening the collaborative mechanism between intelligent assistance and teacher-led teaching, in order to build a more balanced and effective new paradigm of human-machine collaborative teaching. With the continuous development of artificial intelligence and educational concepts, the deep integration of AIGC and vocational education will provide important support for the construction of a high-quality education system.

Disclosure statement

The authors declare no conflict of interest.

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On the Ideological-Political Teaching Design of Comprehensive English from the Perspective of Cultivating Critical Thinking: A Case Study of the Text “A Dill Pickle”

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Abstract: The ideological-political construction of foreign language courses requires full exploration of vigorous and valuable elements and scientific teaching design to integrate knowledge transfer, ability cultivation, and value shaping. With a case study of the selected text “A Dill Pickle” from the textbook “Contemporary College English,” this paper explores how to cultivate critical thinking through ideological and political teaching design in the Comprehensive English course. A three-stage model of text deconstruction, cognitive conflict, and language output is constructed to guide students to foster critical thinking and intellectual depth. This study is hoped to provide insights for the theoretical-political construction of foreign language courses based on teaching practice.

Keywords: Curriculum-based ideological and political education; Critical thinking; Teaching design

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1. Introduction

In June 2020, the Ministry of Education of the People’s Republic of China issued the “Guidelines for the Construction of Ideological and Political Education in Higher Education Curriculum.” It has clearly pointed out that it is necessary to integrate value shaping, knowledge transfer and ability cultivation^[1]. As a strategic measure to implement the fundamental task of cultivating morality and cultivating people, this top-level design provides fundamental principles for the reform of foreign language education in universities in China. Foreign language, the core carrier of cross-cultural communication, serves as a significant medium for college students to know and understand the world, as well as the basis for telling the Chinese story well. Therefore, the ideological-political construction of foreign language courses is not only important for college students to develop language ability and competence, but also supports the construction of ideological security and national cultural subjectivity. It is necessary to sort out the teaching content of professional courses, consider the characteristics, thinking methods,

and value concepts of different courses, which aims to explore the ideological and political elements of the courses and integrate them into the teaching design and practice.

Comprehensive English is a mandatory course for freshmen and sophomores majoring in English. This course focuses on the study of the English language, practical application skills, and the development of cross-cultural communication skills. According to the “National Standard for Teaching Quality of Foreign Languages and Literature,” this course systematically pursues the dual goals of language proficiency and humanistic literacy. However, there is a phenomenon of “superficial value guidance” in the present teaching practice, and it is urgent to explore in-depth paths for the mutual integration of the linguistic symbol system and the ideological and political discourse system.

Texts selected in the series of textbooks “Contemporary College English” are classic literary masterpieces, which aim to cultivate students’ analytical and critical thinking abilities while providing comprehensive and systematic training in English listening, speaking, reading and writing to cultivate a comprehensive set of English skills. Taking the text “A Dill Pickle” in Unit 3, Book 3 as an example, this paper aims to illustrate the ideological-political teaching design of this course from the perspective of cultivating critical thinking. The author has constructed a three-stage model of text deconstruction, cognitive conflict, and language output to guide students to deconstruct the implicit power relations in the text, such as gender identity, which enables students to achieve critical cognition in language learning activities and realize the unity of instrumental rationality and value rationality in English courses. This paper explores the principles and methods of integrating ideological-political elements in selected classic texts, and figures out the mechanism for the collaborative realization of developing critical thinking and ideological-political education. With classroom teaching practice, it is hoped to take on theoretical and practical significance for the ideological and political education in foreign language courses.

2. Literature review

Since the National Conference on Ideological and Political Work in Colleges and Universities in December 2016, curriculum-based ideological and political education has become an important direction for higher education reform^[1]. In recent years, it has gradually become involved in subject teaching, and experts and scholars have conducted a series of discussions on the theoretical and practical issues of ideological and political construction in foreign language courses^[2]. Sun Youzhong explained the basic principles and methods of designing foreign language textbooks in colleges and universities from the perspective of curriculum-based ideological and political education^[3]. Wen Qiufang interpreted the connotation of ideological and political education in foreign language courses. “With teachers of foreign language departments as the main force, great efforts are mainly spared to the following five aspects: teaching content, classroom management, course evaluation, and teachers’ behavior and manners. The concept of ‘cultivating morality and cultivating people’ is integrated into every link of foreign language classroom teaching, which is committed to playing an active role in shaping students’ correct worldviews, life outlooks and individual values^[4].” Hu Jiehui proposed four strategies for systematically optimizing the ideological and political teaching design of foreign language courses with practical cases, including accurate objectives, systematic content, progressive teaching progress, and integrated evaluation feedback^[5]. Wang Xiaojun systematically sorted out the relevant literature on “ideological and political education in foreign language courses” and analyzed its main research hotspots in colleges and universities. The research on ideological and political education in undergraduate-level courses mainly focuses on the practical research of a certain course. In terms of the construction of the evaluation system, the existing research mostly

centers on College English courses, while the research on courses for foreign language majors is comparatively underdeveloped ^[6]. Xu Jinfen elaborated on the overall principles of ideological and political content construction in English course teaching in colleges and universities, which refers to “student-centered teaching, guided by disciplinary nature and based on institutional characteristics.” Xu proposed specific strategies for the construction of ideological and political content. Through three steps of analysis, selection and supplementation, it is hoped to excavate and expand the ideological and political elements embedded within the English teaching materials. Furthermore, ideological and political elements are integrated into the development of new teaching materials across several stages, such as goal setting, corpus selection, activity design and effect evaluation ^[7].

Language is a means of developing higher-order thinking skills. In language teaching, this means that students do not learn language for its own sake but rather to develop their thinking skills and apply these to situations beyond the language classroom ^[8]. At the advanced stage of language learning, the connotation of language proficiency includes critical thinking skills, which include the ability to interpret, analyze and evaluate input information, as well as the ability to reason and understand based on information obtained indirectly or directly ^[9].

3. Theoretical framework

Critical thinking is the core goal of higher education. According to Paul and Elder there are two essential dimensions of thinking that students need to master in order to learn how to upgrade their thinking. They need to be able to identify the “parts” of their thinking, and they need to be able to assess their use of these parts of thinking ^[10]. In the Paul-Elder critical thinking model, the intellectual standards must be applied to the elements of reasoning and the intellectual traits result from the consistent and disciplined application of the intellectual standards to the elements of thought ^[11].

Critical thinking in foreign language learning requires the dual focus on development of language proficiency and thinking qualities. In view of this particularity, Wen Qiufang has proposed a hierarchy theory model of critical thinking ability in foreign language learning, which refines critical thinking ability into two levels, meta-critical thinking and thinking ability ^[12]. The abstract thinking standard is transformed into a progressive ability chain of “text analysis-reasoning logic-viewpoint evaluation-cognition construction,” which clarifies the structure of critical thinking ability in foreign language learning. This approach facilitates the adaptive integration of critical thinking within the discipline of foreign languages and provides an available assessment framework for foreign language teaching. However, its implementation in the classroom still requires specific pedagogical methods for support. Based on what has been mentioned, this paper proposes a teaching method of problem-driven, evidence analysis, and comparison from multiple perspectives for fostering critical thinking in foreign language learning. It is suggested to stimulate students’ cognitive conflicts through designing controversial questions to guide them from superficial textual interpretation to deep critical analysis. As shown in **Figure 1**, a three-stage model of text deconstruction, cognitive conflict, and language output is developed from the perspective of cultivating critical thinking.

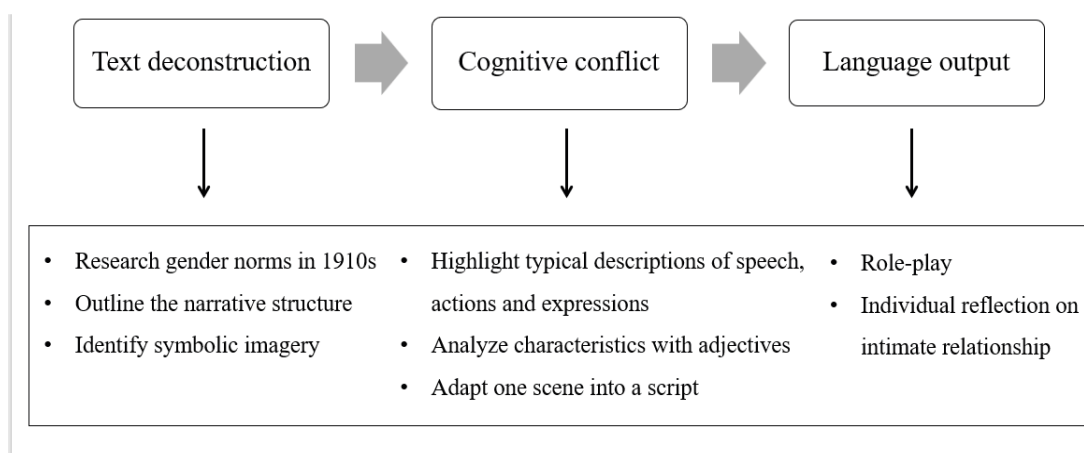


Figure 1. Three-stage model.

4. Teaching design

With the integrated theoretical framework and the three-stage model, this section takes “A Dill Pickle” from Unit 3 of “Contemporary College English 3” as a case study to elaborate the specific teaching design with teaching practice. This study seeks to explore how to balance the teaching objectives of foreign language courses and the value requirements of ideological and political education in the teaching design of Comprehensive English, and how to cultivate students’ critical thinking skills through effective classroom teaching.

4.1. Course introduction and student analysis

As a core course for English major, Comprehensive English takes the key task of transforming from “language proficiency” to “discipline literacy.” According to the “Undergraduates’ Talent Cultivation Program for English Majors in 2021” held by the School of Foreign languages, this course corresponds to four graduation requirements, including disciplinary foundation, teaching skills, disciplinary education for student development and cooperative ability, among which the first one provides strong support. “Contemporary College English 3” edited by Yang Limin serves as the textbook for this course. The target students are 40 sophomores majoring in English. Based on the classroom teaching feedback and comprehensive teaching evaluations from the prerequisite course Comprehensive English 1 and 2 in the previous two semesters, an analysis of the specific characteristics of the students in this class is presented as follows.

First, as for English proficiency, students possess a relatively solid foundation in linguistic knowledge such as grammar and vocabulary. However, they exhibit deficiencies in pragmatic knowledge, including textual and rhetorical analysis, translation practice. Their overall language application and production abilities are relatively weak, with significant individual differences in oral expression skills.

Second, students demonstrate a positive attitude towards English learning with strong intellectual curiosity. The majority of them have well-defined future career plans with clear learning objectives. As they are set to take the TEM 4 (Test for English Majors-Band 4) in the upcoming semester, some students perceive professional learning primarily as preparation for language proficiency tests, indicating a need to refine their personal learning strategies and methods.

Third, they are enthusiastic about using digital learning tools and demonstrate a certain level of independent thinking and teamwork capabilities. However, it is necessary to encourage them to develop a habit of actively

expressing personal viewpoints in class. Additionally, there is room for improvement in their English language output and cross-cultural communicative competence.

4.2. Exploration of ideological and political elements

Xu Jinfen elaborated the overall principles for the construction of ideological and political content in teaching materials for college English courses, and proposed a three-step approach of “analysis-screening-supplementation” to explore and expand the ideological and political elements within existing English teaching materials^[7]. Chen Fachun argued that to effectively implement ideological and political education in courses, foreign language teachers should closely follow social hot issues, identify the convergence, intersection and entry between professional course instruction and current affairs^[13]. The textbook is always behind the changes in the real world. therefore, it is essential for professional teachers to design discussion topics related to the social reality.

The classic literary texts in the textbook of this course contain rich elements of ideological and political education. Due to a lack of systematic integration, it is necessary to conduct extensive expansion and in-depth interpretation based on the teaching objectives of this course. Additionally, appropriate extracurricular materials should be supplemented according to the points of ideological and political integration, so as to achieve organic integration with the textbook content.

The teaching content of this unit, “A Dill Pickle” is taken from Unit 3 of Book 3. This unit includes two reading passages, Text A “A Dill Pickle” and Text B “The Invisible Japanese Gentlemen”, along with multiple exercise tasks. Given the limited class time, the focus of in-class teaching for this unit will be on Text A as the intensive reading, while Text B will serve as supplementary, extensive reading material for after-class study. “A Dill Pickle” is a short story by British author Katherine Mansfield, published in 1917. It is about a young man and a young woman who were once lovers and now meet again after a six-year separation. A dual perspective has been employed in the narrative with the technique of stream of consciousness downplaying traditional plots. It focuses on the characters’ psychological experiences through fragmented memories. The language is concise yet profoundly meaningful, conveying the dynamics of the characters’ relationship through symbolic details. The open-ended conclusion leaves readers with ample space for contemplation.

The focus of ideological and political education in this unit centers on cultivating emotional rationality and subjective awareness. Through three stages of textual analysis, value discrimination, and real-world application, students are guided to establish a healthy cognitive framework for intimate relationships. By delving into the complex emotions and personality traits of the characters, students are to analyze the female protagonist’s struggle between emotional recollections and rational departure, contemplating how to maintain clear judgment amidst intricate interpersonal dynamics and engaging in dialectical discussion on the essence of true love. This process facilitates the transition from literary understanding to personal life experience, which encourages students to critically examine intimate relationships, cultivate rational emotional awareness, construct a dialectical perspective on marriage and love, and explore self-construction in emotional education through literary interpretation.

4.3 Setting teaching objectives

First, as for knowledge objectives, students are expected to: (1) understand the social status of women and gender politics during the era in which Mansfield wrote her works; (2) master the usage of key words and expressions; (3) comprehend the rhetorical device of symbolism.

Second, regarding skill objectives, students are expected to: (1) identify narrative features of modernist

literature, grasp dual narrative structures, and appreciate the characteristics of stream-of-consciousness writing; (2) acquire and apply writing techniques such as symbolism; (3) reveal unequal power relations through analysis of speech proportions; (4) critically analyze the complexity of characters' personalities based on the development of the storyline; (5) deepen understanding of the original plot and characters' emotions through role-play.

Third, with respect to educational objectives, students are projected to: (1) deconstruct power discourses within the text to reflect on and recognize their self-worth; (2) maintain clear judgment in a complex interpersonal society, identify emotional manipulation, think rationally about emotional decisions, and cultivate social critical awareness; (3) contemplated the nature of true love and fostered a healthy perception of intimate relationships.

4.4. Design of the teaching process

Critical thinking ability do not develop spontaneously during the reading process; instead, it require teachers to design relevant activities aimed at cultivating such abilities^[14]. By engaging in critical interpretations of literary words and conducting inferential analyses of their underlying connotations, students can improve the integrated development of their linguistic and critical thinking competences during textual analysis. In the instructional design process, it its essential to first set critical thinking and educational objectives based on the theme of the text, refine specific critical thinking skills and qualities, and identify integration points between critical thinking and language abilities within teaching activities. Integrating the Production-Oriented Approach (POA) proposed by Wen Qiufang, the cyclic sequence of “motivation-enabling-production-assessment” should be consistently applied throughout every teaching process from pre-class to after-class^[15].

Before class, a motivating segment tailored to the text's content and theme is to be crafted. A detailed explanation of the output tasks for this unit will be provided on Chaoxing Learning Platform, and supplementary reading materials will be shared with students so that they can clearly understand the teaching objectives, as well as the key and difficult points of this unit. Before-class teaching design is set to break down the unit objectives, design classroom activities, and optimize the guidance methods for language, content, and text structure. It is essential to combine the text content with the identified integration points between language learning and ideological and political education, and establish the fundamental objective of ideological and political education to cultivate students' healthy emotional and cognitive abilities.

Students' pre-class preview primarily focuses on two aspects, language and discourse. They are required to cStudents' pre-class preview primarily focuses on two aspects, language and discourse. They are required to complete the learning of vocabulary and expressions, and know how to use them within the text context. Additionally, students should read the text and make mind maps to organize the text structure, enabling them to summarize and outline the content of the text for subsequent sharing in classroom activities. As for the warm-up activities, a video titled “What Is Love?” will be shown to introduce the main topic of the text. Students will then quickly skim through the English article “To marry or not is a big question” from “China Daily” and make a summary. Based on the reading, they are encouraged to reflect on questions such as “Do you believe that marriage should be a lifelong commitment?” “Are there any changes in people's attitude toward love, marriage, and family in recent decades?” and “How do you like these changes?” Following this, students will engage in group discussions on the topic “What qualities do you think a man or a woman should be looking for in a potential ideal spouse? Why?” Background information mainly consists of three aspects: an introduction to the life experience and writing style of the author Mansfield, an overview of the Victorian era and an exploration of women's social status and gender politics during that time. Students will be guided to summarize the writing style and characteristics of the text based on the text structure they have figured out during their pre-class preview.

What's more, the key concept of "Stream of consciousness" writing style will be briefly introduced.

The key teaching focus of this unit is to guide students in applying critical thinking skills to analyze and interpret the text, enabling them to understand character portrayal and subtle psychological changes under the stream of consciousness writing style, as well as to figure out how the author presents female emotions through a dual narrative structure. Based on that, students will be tasked with rewriting the text into a screenplay and recording a role-play video. Drawing upon the previously established three-stage model of text deconstruction, cognitive conflict, and language output, teaching activities will be designed to foster students' critical thinking abilities.

At the first stage of text deconstruction, students will utilize the mind maps they completed during the pre-class preview to analyze the narrative characteristics of the text. By identifying symbolic imagery and temporal clues, they will divide the fragmented plots into different scenes, thereby grasping the narrative structure and preparing for subsequent task-related output activities. A notable feature of this text is its deviation from traditional novelistic expression, as the author breaks through temporal and spatial boundaries, employing a three-dimensional interwoven descriptive approach. The development of the narrative plot can be organized into the following six scenes: the reunion at the Café, the first afternoon spent together at Kew Gardens during the early stages of their romance, the male protagonist's travel experiences in Russia, his recollections on the Volga River, Christmas Eve, and the scene of Vera's departure (**Table 1**).

Table 1. Scene, narrative perspective and symbolic imagery analysis framework

Scenes	Narrative perspective	Symbolic imagery
Reunion at the Café	Third-person limited perspective (female focalization)	A Japanese Vase with paper daffodils; Vera's veil; high fur collar
The first afternoon spent together at Kew Gardens	Dual perspective alternation (his romanticized version & her traumatic memory)	Flowers; wasps
His travel experiences in Russia	Monologic male narration	The boatman's song
His recollections on the Volga River	Embedded male focalization	Coachman; Dill pickle
Christmas Eve	Female flashback narration	A little pot of caviar
Vera's departure in silence	Omniscient objective perspective	The strange beast in her bosom; The glove; the cream

Students will be divided into six groups, and each group will be assigned one scene. They are required to read the corresponding part, mark out the symbolic imagery and then engage in in-class group discussions to interpret and analyze the connotations of these images. After the discussion, each group will select a representative to summarize and share their findings. The main symbolic images include dill pickles, paper daffodils in a Japanese vase on the table, veils and gloves, the piano, and the "beast" within Vera's heart.

As for the analysis and interpretation of characters, first, students will be guided to analyze the personality traits of Vera and the man by examining the sentences in the text that describe their appearances, languages, actions, and psychological states. An online discussion topic will be posted on the Chaoxing Learning Platform, requiring students to present the characters' personality traits with adjectives, based on which, two word-cloud diagrams will be generated to visually show the personality traits of Vera and the man. After that, students are encouraged to think about whether there have been any changes in their personality traits and make a comparative analysis to explore the reasons behind these changes.

Based on close reading, in-class explanation and discussion activities, students have a better understanding of the text's content and characteristics. They are guided to compare it with the writing structure of traditional narrative works, which emphasize the coherence of linear storytelling, while in this text, memories are interwoven through the real-life scene. Furthermore, students are encouraged to analyze and summarize the defining features of modernist writing style with symbolic imagery, fragmented plots, trivial themes, and psychological insight.

The unit group project will be posted on Chaoxing Learning Platform. As for the assignment, students are to work in groups of 4-5 and dramatize the scene of their re-encounter. Besides recording a video, each group member should explain "What is love?" with one sentence at the end of the video based on their understanding of the theme of the text. The rewriting of the script and role-play in this task are based on their in-depth understanding of the text, as well as their interpretation of the characters' psychological changes. Scripts, videos and detailed division of work are to be uploaded to Chaoxing Learning Platform, and the videos will be shown in class. Therefore, the overall evaluation consists of teacher evaluation, intra-group evaluation and inter-group evaluation. The main evaluation criteria are illustrated in **Table 2**.

Table 2. Evaluation criteria for drama performance

Student Evaluation Form for Drama Performance					
Group number					
Presenter's name					
Criteria	Excellent (5)	Proficient (4)	Developing (3)	Needs improvement (2)	Score
Adaptation of plot	Faithful yet innovative reinterpretation of source material	Clear alignment with original plot, minor creative liberties	Partial adherence to original story	Significant deviations or inconsistencies	/5
Emotional nuance	Depth of tone: conveys layered subtext	Appropriate tone with moments of subtlety	Basic emotional expression	Limited or inconsistent emotional range	/5
Physical expression	Purposeful gestures/postures enhance meaning	Effective use of body language	Some physical awareness	Minimal or distracting movement	/5
Technical execution	Flawless pacing/blocking/ audio-visual integration	Strong technical control with minor flaws	Functional but unpolished execution	Technical issues hinder performance	/5
Thematic insight	Profound engagement with core themes	Clear thematic understanding	Surface-level treatment	Themes unclear or misrepresented	/5
Bonus points	Exceptional creativity/ critical reinterpretation; notable original elements; one standout innovation				/3
Total scores					

5. Teaching implementation and reflection

During the process of analyzing characters' personality traits, the majority of students agreed that the man was extremely self-centered, selfish, hypocritical, and vain. They were able to find corresponding descriptions in the text to support their viewpoints. For instance, the man exhibited a strong desire for attention, frequently seizing the initiative in the conversation to occupy a dominant position. He also completely ignored Vera's feelings. When she mentioned that she had no time to enjoy music and had sold her beloved piano, he did not pursue the

topic further but instead redirected the conversation back to himself, continuing to boast about his past travel experiences.

In actual classroom teaching, the teacher has introduced the paper “Interplay between Overt and Covert Progressions: Single and Twofold Irony in ‘A Dill Pickle’” to the students. With this paper, students are inspired to analyze the characters and understand the theme of the text from a different perspective. Shen Dan points out that previous interpretive frameworks only focused on the narrative progression of plot development, neglecting the parallel track of meaning-making that runs alongside it. By analyzing the dual narrative progressions in “A Dill Pickle”, the overt plot development and the covert underlying progression that interplay with each other, this study has pointed out the limitations of previous criticism^[16]. Regarding the interpretation of literary works, Roland Barthes proposed granting readers the freedom to interpret texts in his essay “The Death of the Author”^[17]. Consequently, the themes of the novel become more complex, and the character portrayals more nuanced and fully fleshed out.

The course Comprehensive English encompasses a substantial amount of teaching content and entails heavy teaching tasks. Therefore, in terms of classroom instruction, it is necessary to leverage information technology to enhance students’ self-learning abilities and collaborative learning capacities. One of the ideological and political education objectives of this unit is to guide students in establishing a healthy cognition of intimate relationships. Consequently, the evaluation of teaching implementation effectiveness in the dimension of ideological and political education should be a dynamically evolving process, fully integrating knowledge transfer, moral education and value guidance within the teaching assessment framework. While the current approach of combining formative and summative evaluations, along with diversified evaluation subjects, can get relatively comprehensive and objective assessment results, students’ values and emotional decision-making are not limited to the learning of this course. Traditional quantitative evaluation methods still exhibit certain limitations in this regard.

6. Conclusion

To fulfill the fundamental task of cultivating morality and cultivating people, it is imperative to integrate values shaping, knowledge transfer, ability cultivation and value shaping. The comprehensive promotion of ideological and political education in curriculum construction aims to embed values guidance within knowledge transfer and ability cultivation, thereby assisting students in developing correct worldviews, outlook on life and values. There are abundant ideological and political elements in the textbooks of foreign language professional courses, but teachers still need to integrate and improve the teaching content systematically, which requires to identify appropriate angles for cultivating students and enhance teaching ability. The teaching focus of English major courses should not only rest on basic language skills such as listening, speaking, reading, writing and translation. It is of great significance to foster students’ innovative abilities to think, analyze and solve problems in English. The cultivation of critical thinking skills should be permeated throughout course teaching activities. Based on the cultivation of critical thinking abilities, a three-stage model of text deconstruction, cognitive conflict and language output is constructed in this paper. Taking the unit teaching design of “A Dill Pickle” as an example, it demonstrates how to combine the cultivation of critical thinking with ideological and political education by elaborating on the excavation and supplementation of ideological and political elements, the setting of course objectives and specific teaching process. It is hoped to provide insights for theoretical-political construction of foreign language courses based on teaching practice.

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Research on Strategies for Improving Classroom Teaching Quality of “College Foreign Language (Thai)” in Applied Universities Based on the “New Three Centers”

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Abstract: With the deepening advancement of the Belt and Road Initiative, cooperation between China and Southeast Asian countries has become increasingly close and frequent, and Sino-Thai cooperation has also been continuously deepened. Guided by this background, the social demand for Thai language talents is growing rapidly, especially in fields such as tourism, economy and trade, and cultural exchanges. Professional talents with Thai application capabilities are gradually gaining attention. Therefore, current applied universities need to target the talent needs in regional economic development to improve the classroom teaching quality of “College Foreign Language (Thai)” in the talent training process, thereby continuously enhancing students’ language practical ability and cross-cultural communication literacy. In addition, with the rapid development of the education field, the concept of the “New Three Centers” has gradually become the core guiding ideology for college teaching reform, exerting new impacts on the current teaching system and teaching model. Therefore, integrating the “New Three Centers” teaching concept into the teaching of “College Foreign Language (Thai)” in applied universities can help teachers better focus on student development and optimize the overall teaching effect.

Keywords: New Three Centers; Applied universities; College Thai; Teaching quality; Improvement strategies

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1. Introduction

The concept of the “New Three Centers” has gradually emerged in the development of modern educational theories. Its application has broken the traditional one-way teaching model centered on teachers, shifted to focusing on students’ individual development needs, and emphasized that teaching activities should revolve around students’ development, learning processes, and learning effects, which is highly consistent with the teaching philosophy of applied universities. Therefore, integrating the “New Three Centers” concept into the reform of Thai classroom teaching can not only effectively stimulate students’ learning initiative and participation but also promote the close combination of curriculum content and practical application, thereby improving the

overall quality of Thai teaching. Starting from the connotation of the “New Three Centers,” this paper deeply analyzes the compatibility between the “New Three Centers” concept and Thai teaching in applied universities, and discusses specific strategies for improving the classroom teaching quality of “College Foreign Language (Thai)” in applied universities from the perspective of the “New Three Centers.” It is hoped that, combined with the actual situation of Thai teaching in applied universities, practical teaching optimization paths can be proposed.

2. Connotation of the “New Three Centers”

The main content of the “New Three Centers” is centered on student development, centered on student learning, and centered on learning effects. It is a new educational concept emerging in the process of new-era development. This new educational concept emphasizes that education should serve students’ all-round development, forming a contrast with the traditional classroom teaching concept centered on teachers, textbooks, and classrooms. Under the guidance of the “New Three Centers” concept, teachers will adhere to the dominant position of students in the teaching process, pay attention to the individual differences among students, and focus more on students’ personalized development needs in the entire education process, emphasizing the construction of a teaching system centered on student development ^[1]. Specifically, guided by the “New Three Centers” concept, centering on students has become the core goal in the teaching system, and teachers should also respect the dominant position of students and the individual differences among them in the teaching process. Different students have different learning needs in their personal development and learning processes, and their own cognitive laws and career plans will have certain differences. Therefore, the “New Three Centers” emphasizes meeting diverse learning needs through personalized teaching design and diversified teaching methods ^[2]. Finally, centering on learning effects can ensure the final teaching quality to a certain extent. In practice, the “New Three Centers” places more emphasis on the orientation and timeliness of evaluation, guiding teachers to comprehensively assess students’ comprehensive literacy, such as language knowledge mastery, application ability, and career adaptability, by combining process evaluation and summative evaluation. In this way, a diversified and process-oriented evaluation system can be established to ensure the further improvement of the final teaching quality ^[3].

3. Compatibility between the “New Three Centers” concept and Thai teaching in applied universities

3.1. Compatible with the practical orientation of applied talent training

Cultivating students’ practical Thai application ability is the core goal of Thai teaching in applied universities, and it can also lay a solid foundation for students’ subsequent work in fields such as Sino-Thai trade, tourism services, and cultural exchanges ^[4]. The “New Three Centers” concept emphasizes the practicality and applicability of learning, advocating the close combination of language learning and real scenarios, and constructing a practical and contextualized learning model, which is consistent with the talent training goal of applying what is learned in Thai teaching. At the same time, combining teaching methods such as task-driven learning and project-based learning can integrate language learning with the completion of practical tasks, allowing students to improve their comprehensive application abilities, such as listening, speaking, reading, writing, and translation in the process of completing tasks, thereby achieving a seamless connection between language skills and career needs ^[5].

3.2. Compatible with the inherent requirements of teaching quality improvement

Currently, Thai teaching in applied universities still faces some problems. Essentially, these problems arise

because current teaching activities over-rely on traditional lecture models, deviating from the orientation of student development and learning effects ^[6]. The “New Three Centers” concept, centered on student development, learning effects, and output-oriented, can effectively solve the problems existing in the current teaching process and promote the transformation of teaching from what has been taught to what has been learned.

4. Strategies for improving classroom teaching quality of “College Foreign Language (Thai)” in applied universities from the perspective of the “New Three Centers”

4.1. Reconstruct teaching objectives based on student development and career needs

In the entire teaching process, teaching objectives are an important basis to ensure that the current teaching direction is consistent with the final talent training goal. Therefore, professional teachers should comprehensively assess the current teaching situation and students’ actual development status, confirm students’ learning needs in the current stage of development, and reconstruct the teaching objective system around this to ensure that subsequent teaching activities can be accurately aligned with students’ future career needs ^[7]. When setting knowledge objectives, teachers need to ensure that students can fully understand basic Thai language knowledge and industry-related professional knowledge, lay a solid theoretical foundation for them, and ensure that students can smoothly enter the next more difficult learning stage. The setting of ability objectives should highlight the cultivation of practical application abilities, combine students’ abilities in listening, speaking, reading, writing, translation, etc., with real work scenarios, and also focus on cultivating their autonomous learning abilities and problem-solving abilities ^[8].

Finally, in the design of literacy objectives, it is necessary to pay attention to the cultivation of students’ cross-cultural communication literacy and professional literacy, guide students to deeply understand Thai social culture, values, and different behavioral norms, thereby continuously enhancing their sensitivity in cross-cultural communication. Through a deeper understanding, it can further enhance their sense of identity and responsibility for future careers, laying a solid foundation for them to be competent in jobs in a multicultural environment in the future. In addition, different students have different learning needs in the learning process, so teachers also need to establish hierarchical teaching objectives when constructing teaching objectives ^[9]. In this way, students with different learning needs or learning abilities can be targeted to improve, and the overall teaching quality can be guaranteed ^[10].

4.2. Innovate teaching models focusing on learning processes and practical experience

When innovating teaching models, teachers need to adhere to the student-centered educational philosophy, break the stylized teaching model where teachers dominate, and students passively receive knowledge in traditional teaching, and construct a diversified teaching model system for students by integrating contextualized and task-driven teaching forms, so as to continuously improve the effectiveness and interest of the entire teaching activities ^[11]. On the one hand, teachers can use new media technology and virtual reality means to build a virtual simulation environment, displaying typical scenarios of Thai applications for students, such as airport pick-up, business negotiations, tourism interpretation, document translation, etc. Students can use Thai to complete more specific tasks in the scenarios, including introducing tourist attractions in Thai, handling customer complaints, or giving speeches in business meetings. This learning form can effectively exercise their language application abilities and improve their mastery of the learned knowledge. Teachers can also set unexpected problems to further improve students’ adaptability and cultivate cross-cultural communication skills ^[12].

At the same time, in the teaching process, front-line enterprise personnel can be regularly invited to participate in teaching guidance, enabling them to directly observe students’ task performance and provide comments, thereby greatly

improving the authenticity and pertinence of teaching. On the other hand, teachers can also introduce a task-driven teaching model. By setting specific learning tasks for students to integrate teaching content into them, and guiding students to complete the corresponding tasks in the form of group cooperation, the connection between knowledge and skills in their entire learning process can be further deepened. For example, teachers can assign the task of planning a “Thai Cultural Week,” divide students into multiple groups, and let each group be responsible for planning activities with different themes, such as traditional festival experiences, food exhibitions, folk performances, etc. During the implementation of the task, students need to communicate and display in Thai throughout the process, and complete the entire process from plan writing, resource coordination, to on-site simulation execution, thereby comprehensively exercising their language organization abilities and teamwork abilities^[13].

4.3. Build a resource system to support personalized learning and practical teaching

In terms of resource system construction, it is necessary to build a diversified teaching resource system centered on learning effects to solve problems such as insufficient practical resources and poor resource adaptability, thereby providing strong support for students’ personalized learning and practical training^[14]. Specifically, universities can develop characteristic textbook resources for school-enterprise collaborative education. Cooperate with Thai-related industries and enterprises to jointly develop school-specific textbooks and practical training manuals, integrating real enterprise cases, work processes, and post needs into the textbook content to ensure that the teaching content is closely aligned with industry practices. At the same time, typical work cases, practical processes, and professional skill requirements can be integrated to reduce purely theoretical teaching content and enhance the practicality and pertinence of textbooks. In addition, a diversified practical training resource platform can be constructed, integrating internal and external resources to create an online-offline hybrid practical training environment^[15]. On campus, Thai scenario simulation laboratories, virtual business meeting rooms, and cross-cultural communication simulation centers can be built, equipped with intelligent speech recognition systems, simultaneous interpretation training equipment, and multilingual databases to meet the practical training needs of students at different levels. Off campus, the depth of school-enterprise cooperation can be further deepened, and off-campus practical training bases can be established to provide students with real post practice opportunities, enabling them to exercise their skills in actual work.

5. Conclusion

In the process of classroom teaching reform of “College Foreign Language (Thai)” in applied universities, the “New Three Centers” educational concept can effectively promote the reconstruction of the current teaching system. By integrating a teaching model centered on student development, output-oriented, and taking continuous improvement as the path, the overall effect of education and teaching can be further improved, thereby promoting the systematic improvement of teaching quality.

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Research on the Practical Paths of Life Education for College Students

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Abstract: For Generation Z, the rapid development of the social economy and internet information technology has brought unprecedented challenges to the physical and mental health of college students. Proper guidance on life outlook and life values plays a crucial role in college students' personal development, mental health, and social adaptability. This paper points out the significant value of life education in enhancing the sense of life value, improving life quality, and promoting social harmony. It analyzes the practical dilemmas faced in life education practice, such as the gap between theoretical research and practical application, insufficient support for life education in the existing education system, and college students' weak awareness of life. Based on the goals and content of life education, it explores specific educational practice paths, including curriculum design, teacher team building, campus culture construction, home-school-community collaboration, and the application of modern technology, to create comprehensive and multi-dimensional life education. The aim is to help college students establish a correct outlook on life, enhance life value, lay a solid foundation for future development, and promote social harmony.

Keywords: Life education; Life values; Mental health; Practical paths

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1. The importance and necessity of life education

Life education is the foundation of traditional education, relating to personal all-around development, family happiness, and social sustainable development. Over the past three decades, incidents of suicide and homicide among college students caused by psychological problems have emerged one after another, such as the 1996 Nanjing University Corpse Dismemberment Case, the 2004 Yunnan University Ma Jiajue Case, the 2011 Central South University "5·8" Campus Love Murder Case, the 2015 Fudan University Poisoning Case, the 2023 Luoyang Institute of Technology Homicide-Suicide Case, the 2024 Xiangtan University Oatmeal Poisoning Murder Case, and the 2024 Wuxi Vocational Institute of Arts and Technology Graduate Xu Moujin's Knife Attack Case (resulting in 8 deaths and 17 injuries). Additionally, incidents such as college students' hanging, jumping off buildings, and suicide by taking drugs occur almost every year. These tragic campus incidents force us to reflect: "Who is to blame for the frequent occurrence of extreme cases?" Factors include human nature's good and evil,

external environmental influences, etc. How to avoid such incidents? How to conduct pre-intervention for college students' mental health? According to a report by the World Health Organization (WHO), more than 700,000 people die by suicide worldwide every year, and suicide is the fourth leading cause of death among people aged 15–29^[1].

Data shows that the suicide rate of college students in some Chinese universities is about 2.37 per 100,000, and suicide accounts for approximately 47.2% of non-natural deaths^[2]. Facing the multiple challenges of rapid social development and personal growth, college students are encountering unprecedented psychological pressure^[3]. Many college students may feel confused or even desperate about life when facing pressures from academic performance, employment, and interpersonal relationships, leading to suicidal ideation (SI). Suicidal ideation is a strong predictor of suicide attempts and completed suicide, and adolescence and early adulthood are the peak periods for the first occurrence of suicidal ideation^[4]. This not only affects personal healthy development but also poses a potential threat to family and social stability. The fundamental goal of education is to cultivate “people”. Therefore, the importance and necessity of life education for college students have become increasingly prominent. Carrying out life education to help students establish a correct outlook on life, recognize the value of life, and develop a positive, confident, and resilient attitude towards life is the foundation for personal healthy growth and the cornerstone of promoting social sustainable development.

2. Practical dilemmas of life education for college students

2.1. Insufficient national support in legislation, finance, and education

Laws are the criterion for restricting people's criminal behavior. Behind illegal and criminal acts such as intentional homicide, human trafficking, and organ trading, in addition to factors such as profit-seeking and hatred of society, the fundamental reason is the lack of reverence for life and a serious deficiency in life values^[5]. Therefore, life education is not only a universal education that college students need to receive before entering society but also an education that runs through the entire growth process from birth. Thus, strong national support for life education plays a guiding role.

2.2. Lack of death education at the social level

Influenced by traditional Chinese superstitious ideas, people often avoid talking about death, leading to college students' immature understanding of death and occasional disregard for life. When dealing with the death of relatives, friends, or classmates, they may feel confused, indifferent, or immersed in grief for a long time and unable to recover^[6].

2.3. Insufficient attention and support from colleges and universities

Colleges and universities pay insufficient attention to and support for life education, with inadequate coverage and depth of educational content, practical activities that fail to closely meet students' actual needs, and an underdeveloped evaluation system. From the perspective of recognition, educators and students do not attach enough importance to life education, regarding it as an optional component, which directly affects the in-depth advancement of life education. From the perspective of implementation strategies, the existing education system lacks systematic curriculum design, textbook compilation, and teaching method innovation for life education, and the construction of the teacher team is incomplete. From the perspective of practical effectiveness^[7], life education practices are formalistic (such as theoretical lectures and promotional posters), lacking depth

and practical results. They fail to fully mobilize students' enthusiasm for participation, making it difficult for students to empathize, deeply understand the core value of life education, and thus affecting the maximization of educational effects. The evaluation system for life education has not yet been established, resulting in a lack of scientific and systematic methods to measure educational effectiveness^[8].

3. Goals of life education

3.1. Cherish life

Cherishing life is the primary goal of life education. If life is regarded as “1”, the subsequent “0s” (representing achievements, wealth, etc.) are valuable only when “1” exists. When the awareness of cherishing life is deeply rooted in the heart, people can maintain a positive and optimistic attitude when facing setbacks and challenges, show kindness when facing weak lives, and extend a helping hand with goodwill when encountering life crises^[9].

3.2. Create life value

Life value includes multiple dimensions such as personal self-realization, social responsibility, and respect for others and nature. When people recognize that their lives are limited and unique, they generate internal motivation to create life value^[10].

The creation of life value involves overcoming difficulties, continuous reflection in life practice, correctly handling failures and setbacks, continuously enhancing individual resilience and adaptability, unrelentingly pursuing and inheriting personal ideals, and forming a positive cycle of life value.

3.3. Enhance life value

The goals of life education are comprehensive. It guides students to recognize the importance of life, respect and cherish life, and maximize life value^[11]. It includes the cultivation of survival skills, life cognition, emotions, and values, as well as psychological adjustment and moral cultivation when facing the fragility and impermanence of life.

To achieve the enhancement of life value in practical education, it is necessary to balance theoretical depth and practical breadth. For example, integrate life education elements into mental health courses, offer courses on life safety and security education, and hold seminars on life value and meaning. Relying on modern technology, carry out online life education courses through network platforms to expand educational boundaries and provide students with more flexible and diverse learning approaches. It is also necessary to combine students' personal life practice with social practice^[12]. Through participating in social services, volunteer activities, scientific research innovation, etc., students integrate the realization of self-value with the needs of social development, achieving socialization and personalized development of life.

4. Content system of life education

Life education covers life knowledge education, life skills education, life emotion education, death and funeral education, and cultural life education^[13].

4.1. Life knowledge education

Systematically impart life science knowledge to improve college students' level of life science knowledge.

Enable them to comprehensively understand human biological characteristics, the origin and evolution of life, and methods for the prevention and treatment of common diseases, establishing a basic cognitive framework for life science, thereby enhancing their cognition and respect for life value^[14].

Life knowledge education also includes the scientific cognition of life phenomena, such as the origin and development of life and the basic laws of life activities. It enriches college students' scientific knowledge reserve, stimulates their interest in scientific inquiry, and cultivates their scientific thinking abilities.

Life knowledge education is also the foundation for realizing life safety education. Systematic learning of life science knowledge allows college students to understand the importance and methods of safety protection, enabling them to take correct preventive measures to protect themselves and others when facing potential life dangers^[15].

4.2. Life skills education

Systematic life skills education is an important part of life education practice. Life skills education covers a wide range of content, including the cultivation of survival skills (such as first aid skills and disaster escape knowledge), which are basic skills to ensure individual safety. It also includes health management skills needed in daily life, such as nutrition and health care, and psychological self-regulation. Mastering these skills helps students form a scientific and healthy lifestyle.

4.3. Life emotion education

Life emotion education focuses on cultivating students' mental health, emotional management, and social communication abilities. Its core is to help students recognize and accept their emotional experiences, learn to express and regulate their emotions healthily, develop empathy, and understand the feelings and needs of others.

4.4. Death and funeral education

In the field of life education, death education and funeral education are sensitive topics that people avoid or fear talking about, but they are indeed important and unavoidable content in life education.

4.5. Cultural life education

Cultural life education emphasizes deepening college students' understanding of life, ethical care, and value pursuit from a cultural perspective. It includes the scientific exploration of the origin, development, and end of life, the cognition of psychosocial adaptation at different stages of life, and the cultural and ethical reflection on life value.

5. Practical paths of life education for college students

5.1. Curriculum design and curriculum system construction

The curriculum design and curriculum system construction of life education for college students provide psychological guarantee for enhancing students' safety awareness, life value, life quality, cultivating a sound personality, and improving their ability to respond to difficulties.

The construction of the life education curriculum system is oriented towards holistic personal development, including life education content in general education and special life education courses as public electives. Integrate life education content in general education into various disciplines, such as discussing the value and

meaning of life in psychology, sociology, or philosophy courses, popularizing life education skills and methods in military theory and labor education, and presenting classic cases of life education in law and ethics courses.

5.2. Construction and development of the teacher team

Teachers are theoretical researchers and educational implementers of life education. Building a professional teacher team in educational practice that can gain insight into students' psychology, detect crises promptly, and establish effective communication is the key to achieving the goals of life education.

5.3. Integration of campus culture and life practice

Integrate campus culture with students' life practice to imperceptibly cultivate students' awareness of respecting, cherishing, and loving life, creating a good environment for the implementation of life education in colleges and universities.

Establish campus institutional culture, such as safety education regulations and psychological counseling support, to provide institutional guarantees for life education. Carry out a variety of campus cultural activities, such as psychological melodramas, community safety officer grid management, and fire safety social practice, allowing students to experience and understand the diversity of life value in actual life safety work scenarios.

5.4. Home-school-community collaboration

The family is the primary position for life education of college students. Family values and educational methods have a profound impact on students' outlook on life. Among college students with psychological problems, the majority suffer from psychological issues or feelings of hopelessness due to family disharmony, tense family relationships, or sudden family changes. Active parental participation and providing a growth environment full of love and respect can play a positive guiding and exemplary role during the formation of students' values.

5.5. Application of internet platforms

The widespread application of network technology has brought new opportunities and challenges to life education for college students. The virtuality and openness of the network environment provide a broader space and diverse educational resources for life education. With the help of network platforms, the interactivity, timeliness, and engagement of education have been significantly enhanced, improving the attractiveness and effectiveness of life education.

6. Conclusion

In-depth exploration and improvement of the practical paths of life education for college students are of great significance for cultivating a sound personality, promoting mental health, and enhancing life value. Curriculum design and curriculum system construction are the foundation of life education for college students. The integration of campus culture and practical life is an effective way to improve the effect of life education. The collaborative cooperation among families, society, and schools builds a comprehensive support system for the life education of college students. The application of modern technology and network platforms provides new perspectives and methods for life education of college students.

In summary, life education for college students is a comprehensive topic that integrates theory with practice. Educational researchers, practitioners, and policymakers need to work together to protect college students'

growth in a healthy psychological environment. Future research should pay more attention to the depth and breadth of theory, the innovation and integration of practice, and the deepening of interdisciplinary and inter-departmental cooperation to jointly promote the development of life education for college students.

Disclosure statement

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Embodiment and Immersion: A Study on the Communication Effect of AI-Driven Virtual Digital Humans in Film and Television New Media Narratives

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Abstract: This paper focuses on the communication effects of AI-driven virtual digital humans in the narrative of film and television new media, with “embodiment” and “immersion” as the core research dimensions. By examining the intervention logic of virtual digital humans in film and television new media narratives, this paper explores the mechanism by which they rely on multimodal interaction to enhance embodied communication and use technology to empower immersive experiences. At the same time, it analyzes the existing problems in current communication practices, reveals the impact paths of embodiment and immersion on communication effects, and provides theoretical references and practical insights for optimizing the application strategies of AI virtual digital humans in film and television new media narratives and enhancing content communication efficiency.

Keywords: AI-driven; Virtual digital human; Film and television new media narrative; Communication effect

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1. Introduction

AI-driven virtual digital humans have gradually become an important carrier for film and television new media narratives in the development process of the current digital era, reshaping content dissemination forms and audience experience modes. Although virtual digital humans have injected new vitality into film and television new media narratives, how to enhance dissemination effects by strengthening embodied interaction and constructing deep immersive experiences remains a problem that we need to actively face, in order to enable audiences to immersively experience virtual narratives. This article takes embodiment and immersion as entry points to systematically explore the dissemination effects of AI virtual digital humans in film and television new media narratives, in order to provide theoretical support for industry development.

2. The communication significance of AI-driven virtual digital humans in the narrative of film and television new media

2.1. Deepening the connotation of embodied communication theory in the era of intelligent media

Marshall McLuhan's theory of "the medium is the extension of man" provides important insights for the study of intelligent communication. In the era of intelligent communication, media is no longer in the physical sense, but rather a medium that connects human intelligence and artificial intelligence, the physical world and the virtual world through data. Each individual is a unit of intelligent communication. AI-driven virtual digital humans use multimodal affective computing, real-time motion capture, and intelligent interaction technology to restore human emotions and physical behaviors, elevating the audience's participation in communication to a multi-sensory experience. The audience not only perceives the virtual digital human image and physical actions through vision, but also establishes instant emotional connections and behavioral interactions with the virtual digital human through voice, text, and even physiological data feedback. This interaction is not indirect communication at the symbolic level, but rather a "somatic experience" closer to real interpersonal communication ^[1].

2.2. Promote innovation in content production models for film and television as well as new media

The content production model of traditional film and television new media exhibits characteristics of "centralization, standardization, and unidirectionality", with the creative team as the absolute core. Standardized content is produced according to a fixed narrative logic and ultimately delivered to the audience in a unidirectional manner. The audience remains in the role of "passive receivers", making it difficult to form an interactive closed loop between content production and dissemination. The intervention of AI-driven virtual digital humans promotes the innovation of the content production model of film and television new media from three levels: production subject, production logic, and production relations. It builds a new production system that is "decentralized, personalized, and interactive", making content production more aligned with market demands and enhancing the dissemination vitality and market competitiveness of film and television new media content ^[2].

2.3. Exploring the future narrative paradigm of human-machine symbiosis

Intelligent communication has achieved focused and precise dissemination of information, making individuals the mainstay in the dynamic communication chain and enhancing the efficiency of information dissemination. The continuous innovation of intelligent communication technology has brought opportunities for the development of the era of intelligent communication. The era of intelligent communication is a "metaverse" level application built on big data and centered around artificial intelligence technology. AI-driven virtual digital humans are the explorers and practitioners of the "human-machine symbiotic narrative" in this exploration and practice process, utilizing the deep interactive relationship of "human-virtual digital human-narrative content" to propose exploratory directions for the construction of future narrative paradigms. The development of AI-driven virtual digital humans in the narrative of new mainstream media in film and television has not only become an innovative practice of current communication methods but also a prelude to the future form of human-machine symbiotic narrative, providing a possible basis for the future development of media narrative.

3. The current status of AI-driven virtual digital humans in the narrative of film and television new media

3.1. Technical bottlenecks lead to awkward “embodied interaction” and insufficient emotional resonance

Digital embodiment has transformed the traditional spatiotemporal logic of “I am here”, altering the communication relationships between people, people and objects, and objects through the virtual-real interactive relationship of the “metaverse”. In the context of intelligent communication, we need to conduct a detailed analysis of the concepts of “human-computer interaction” and “interaction”. Currently, AI’s sentiment analysis of audiences mostly relies on explicit information, such as voice tone and facial expressions, to judge the emotional state of the audience, making it difficult to perceive implicit emotional information, such as micro-expressions and physiological changes, which leads to errors in sentiment judgment. The logic of emotional feedback generation is relatively simple, mostly following preset algorithms to match specific responses, making it difficult to generate reactive feedback based on the complexity of the storyline and the subtlety of the audience’s emotions. Consequently, the emotional feedback of virtual digital humans exhibits a “template-like” characteristic, with action performances and body expressions limited by motion capture technology and AI rendering capabilities. The body movements of virtual digital humans have a “stuttering” and “mechanical” feel, while facial expressions exhibit problems of “exaggeration” and “blankness”^[3].

3.2. The narrative function tends to be “instrumentalized” with a notable lack of character subjectivity

In the current narrative practices of film and television new media, AI-driven virtual digital characters are often positioned as “functional,” with their narrative value limited to instrumental aspects such as attracting traffic, information transmission, and interactive embellishments. They lack the subjectivity and dimensionality that should be inherent to narrative roles, and this “instrumentalization” tendency severely restricts the release of their communicative value. Creators often assign single superficial labels to virtual digital characters, lacking the construction of deep dimensions such as character personality, growth background, values, and behavioral logic, rendering the characters as visual symbols with only external appearances and no internal personality, making it difficult for audiences to generate emotional identification. Virtual digital characters are mostly used in functional scenarios such as opening, information broadcast, and simple interactions, and only occupy a “peripheral position” in the core narrative process, lacking the core role of driving plot development, participating in conflicts, and carrying narrative themes. For example, in interactive dramas, virtual digital characters are only responsible for initiating interactive commands, but do not participate in plot twists and emotional expression, reducing them to “interactive tools” rather than “plot participants”^[4].

3.3. The communication mode is unidirectional, and the audience’s “immersion” is easily interrupted

In current practice, most film and television new media narratives involving virtual digital humans have not yet escaped the shackles of one-way communication. The audience’s participation and control rights are limited, and immersive experiences are easily interrupted by various factors, resulting in the innovation effect of the communication mode not meeting expectations. The current so-called interactive communication is mostly pseudo-interactive. Although virtual digital humans can initiate interactive commands, the audience’s choice range is strictly limited within a preset framework. No matter what choice the audience makes, it will ultimately

lead to a fixed narrative outcome. This “formalized interaction” makes the audience’s sense of participation superficial, making it difficult to generate an immersive experience of “controlling the narrative”. At the same time, there are numerous immersion interruption points in the communication process. On the one hand, technical issues such as interaction delays and content loading stalls directly break the audience’s narrative immersion state, pulling them away from the narrative context. On the other hand, the “disconnection between interaction and narrative” at the content level can also lead to a loss of immersion. The interaction design of virtual digital humans has low relevance to the core narrative theme, such as inserting unrelated entertainment-style interactions into suspense narratives. The one-way nature of the communication mode is also reflected in the “lack of a feedback loop”: the audience’s interactive feedback and emotional expression are difficult to effectively integrate into subsequent content production. Creators still dominate the narrative direction with their own will, and the value of audience participation is not fully respected ^[5].

4. Communication strategies of AI-driven virtual digital humans in film and television new media narratives

4.1. Enhance multimodal affective computing to create embodied interactions that convey “true feelings”

We need to recognize that cognition, emotion, and physical state and activity of the body are inextricably linked. It is important to understand that the audience’s emotional engagement and understanding of narratives do not solely stem from the brain’s decoding of linguistic information, but also rely on the perception and empathy towards the entire embodied performance of the narrative subject. A digital human who can only speak fluently but has rigid expressions and mechanical movements will create a “uncanny valley effect”, which hinders the transmission of emotions. The key to enhancing its communication effectiveness lies in endowing it with embodied interaction capabilities of “true feelings” through multimodal affective computing technology. AI systems are required not only to process text and speech, but also to integrate visual, auditory, and even contextual information for comprehensive emotional judgment and generation ^[6].

Another example is the popularity of the domestic hyper-realistic virtual image “Liu Yexi,” which preliminarily demonstrates the powerful dissemination of embodied interaction. In her released short videos, precise facial expressions and appropriate body movements are deeply integrated with the plot and emotions. For instance, in one of her scenes, the contraction of pupils and the tightness of the mouth corners when facing panic, as well as the gentle touch of her hands when showing pity, greatly enhance the narrative appeal. If combined with multimodal affective computing, it can produce a deeper effect. Imagine if an AI virtual actor performs a farewell scene with complex emotions. This kind of deep and internal emotional expression can penetrate the screen in a second, allowing the audience to not just “hear” a line, but to “feel” the character’s inner melancholy and reluctance, generating a very strong emotional resonance and greatly optimizing the breadth and depth of narrative dissemination ^[7].

4.2. Establish a profound persona and growth arc, achieving the transformation from a “tool” to a “character”

In the past, narratives relied on screenwriters’ shaping and actors’ secondary creation to convey character depth. If AI virtual digital humans only remain at the level of character modeling, they will become mere “means symbols” designed for brand promotion and information dissemination, unable to undertake narrative tasks

with complex meanings^[8]. To transform virtual digital humans from “means symbols” into “characters”, it is necessary to create a reliable “story world” background for them, including their prehistory, motivations, values, flaws, and desires, as well as a clearly identifiable “arc”, that is, the character’s experience of events and inner growth in the story^[9].

For example, the character of Xiangwan, a member of the virtual human group “A-SOUL”, is portrayed as someone who loves playing games, is a little tsundere, but also very hardworking and sincere. After fans have interacted with her through long-term live streaming, she responds to fans and accepts challenges, making Xiangwan’s image more three-dimensional and creating a sense of “growing up together”^[10]. If we want to go deeper, we can design an AI virtual protagonist “Xinghuan” specifically created for the series. Before the show starts, the production team sets up a vast background information for her through AI, such as that she is an alien orphan who suffered a tragic childhood, causing her to fear intimate relationships. Her basic desire is to gain a sense of belonging and recognition, but her personality flaw is an innate tendency to avoid. Therefore, when the series reaches a point where one of the characters tries to forge a deep friendship with “Xinghuan”, the AI will not just give you an answer of acceptance or rejection, but will form a series of responses that fit her “avoidant personality” habits based on “Xinghuan’s” underlying personality database, such as “I - I don’t know, I’ll tell you later”, “Let’s talk about it next time”, “Do you understand? No?” And even at critical moments, she chooses to avoid responsibility and bear it alone. Later, as the plot progresses, at this crucial moment, after her companions risk their lives to save her, she finally experiences the “arc light of Xinghuan”^[11].

4.3. Design branching narratives and real-time interactions to construct an immersive narrative field featuring “audience participation”

Traditional film and television narratives are linear, unidirectional, and “author-centered” in their dissemination, with the audience at the passive receiving end. The immersion experience is easily disrupted by the mismatch between the narrative and personal expectations. However, the combination of AI-driven virtual digital avatars, branching narratives, and real-time interaction transforms the narrative into an open, variable “field of meaning negotiation,” breaking the fourth wall and inviting the audience to shift from being “viewers” to “participants” or even “collaborators”^[12]. AI systems can capture and analyze collective feedback data from the audience in real time, and use this to drive virtual digital avatars to adjust narrative strategies or choose different plot branches. This not only gives the audience an unprecedented sense of agency and control but also creates a strong psychological involvement where “the narrative changes because of me”^[13].

For example, the interactive drama “Black Mirror: Bandersnatch” is an early attempt at branching narratives, but its branching options are preset. Combining AI and virtual digital humans can envision more advanced applications. For instance, in a suspenseful interactive live broadcast drama hosted by the virtual anchor “Li”, the plot reaches a critical juncture where the real culprit is about to be revealed, but the evidence points to two characters^[14]. At this point, AI will not directly advance the plot. Instead, “Li” will turn to the camera and interact with the audience based on real-time comments and live room voting, asking, “Do you think we should investigate the silent butler first, or the emotional mistress? Your choice will determine what we discover next.” The AI system quickly tallies the audience’s choices and activates different plotlines accordingly. Furthermore, when the audience suggests a creative deduction that the screenwriter did not preset in the comments, AI can analyze its reasonableness in real time and prompt “Li” to respond, such as her eyes lighting up and saying, “This detective’s idea is interesting! We did overlook that detail before. Let’s go and check it out now!”^[15].

5. Conclusion

In summary, embodiment and immersion, as core dimensions, profoundly influence the dissemination effect of AI virtual digital humans in film and television new media narratives. Virtual digital humans expand the boundaries of embodied communication through technological empowerment, construct immersive narrative fields, and provide new paths for enhancing content attractiveness and audience engagement. However, issues such as technological limitations and role positioning deviations still constrain the release of communication value. In the future, it is necessary to strengthen the foundation of embodied interaction through technological optimization, enhance emotional connection through deep role construction, improve immersive experience through interactive design, and promote the deep integration of virtual digital humans with film and television new media narratives.

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A Study on Project-Based Teaching Reform of University Lacquer Art Courses under the Orientation of Innovation and Entrepreneurship

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Abstract: This study focuses on the teaching reform of lacquer art courses in local universities against the backdrop of innovation and entrepreneurship education. By systematically analyzing the current operation of lacquer art courses and the College Students' Innovation and Entrepreneurship Training Program, it constructs a four-dimensional curriculum objective framework of "cultural foundation–technical competence–project awareness–innovation and entrepreneurship capability," and designs an innovative spiral learning pathway consisting of in-class incubation, extracurricular training, and competition-based validation. The study integrates multi-dimensional strategies in task design, regulation of teaching rhythm, diversified assessment, and university–local cooperation to promote systematic transformation of course teaching. Drawing on two typical national-level innovation and entrepreneurship projects as cases, it presents the dynamic trajectory from project generation and curricular support to implementation and students' competence development. Empirical results indicate that the innovation- and entrepreneurship-oriented project-based teaching model significantly enhances students' cultural understanding, craft integration skills, problem-solving awareness, and team collaboration, and effectively facilitates the transformation of classroom work into high-level innovation and entrepreneurship projects and market-oriented cultural and creative products. This study provides a replicable and scalable practical pathway and theoretical reference for local universities to further integrate traditional craft courses with innovation and entrepreneurship education.

Keywords: Lacquer art; College students' innovation and entrepreneurship training; Project-based teaching; Curriculum reform

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1. Introduction

With the continuous advancement of "New Liberal Arts" construction and innovation and entrepreneurship education, how to effectively connect traditional craft courses with college students' innovation and entrepreneurship training has become an important issue in talent cultivation for local universities^[1,2]. Traditional

craft courses in art and design education play a dual role in skills training and aesthetic education, and are also important carriers for the inheritance and innovation of excellent traditional Chinese culture ^[3-6]. However, there is still a weak connection between such courses and the College Students' Innovation and Entrepreneurship Training Program (hereafter referred to as "innovation and entrepreneurship projects"). Classroom teaching often focuses on technique transmission and completion of works, while innovation and entrepreneurship projects place greater emphasis on topic innovation and project management. The two are not fully aligned in terms of objectives, pace, and evaluation standards ^[7].

Chuxiong Yi Autonomous Prefecture possesses rich cultural resources in Yi ethnic costumes and lacquerware. Its unique systems of patterns, color structures, and lacquering techniques provide fertile cultural soil for lacquer art courses and offer numerous possibilities for innovation and entrepreneurship project topics. On the premise of ensuring the depth of craft teaching, how to organically integrate innovation and entrepreneurship education into lacquer art courses and promote the transformation of classroom works into high-quality projects has become the core concern of this study.

2. Research background

As an important cluster area of Yi culture, Chuxiong has formed a relatively complete visual and technical system in the patterns, colors, and craftsmanship of Yi costumes and lacquerware. Relying on local resources over many years, lacquer art courses in local universities have developed a teaching framework that covers knowledge of natural lacquer materials, fabrication of wooden and fabric substrates, lacquering techniques, and the application of ethnic patterns ^[8]. However, in the context of new requirements for universities to serve regional culture and industrial development, remaining at the level of classroom product making is insufficient to comprehensively support students' overall competence development ^[9]. How to connect the cultural advantages of Yi lacquer art with the university's innovation and entrepreneurship resources, so that the course can both transmit techniques and stimulate innovation potential, has become the key to teaching reform ^[10,11].

A review of recent course implementation and interviews with teachers and students indicate that the current lacquer art course mainly has three problems:

- (1) The teaching objectives are overly focused on technique training. Course emphasis is placed on material properties, substrate making, and techniques such as inlaying and gold leaf application, while students' problem awareness, project thinking, and teamwork, core literacy for innovation and entrepreneurship, receive insufficient attention. Students can complete technically sound works, but lack systematic consideration of user needs, usage scenarios, and market transformation ^[12].
- (2) There is a mismatch between course pacing and project cycles. The course is organized by semester and weekly sessions, stressing class attendance, phased exercises, and final works. In contrast, innovation and entrepreneurship projects follow an annual cycle with procedures of project approval, mid-term inspection, and final review ^[13]. The lack of alignment in time and task arrangements between the two makes students struggle to cope with both course and project demands, and it is difficult to form a continuous and in-depth learning chain.
- (3) Course evaluation is disconnected from project evaluation. Course assessment focuses on craftsmanship and classroom performance, whereas innovation and entrepreneurship projects emphasize topic originality, process management, and dissemination of outcomes ^[7]. Course outputs cannot be directly transformed into project outcomes, and innovation and entrepreneurship achievements are not effectively

fed back into course evaluation. This weakens students' awareness of the intrinsic connection between courses and projects.

3. Project-based reconstruction of curriculum objectives and structure

To address the limitations of the original technique-centered objectives, the course has been reconstructed around a four-dimensional objective framework of “cultural foundation–technical competence–project awareness–innovation and entrepreneurship capability.”

In terms of cultural foundation, images, physical artifacts, and field investigations are used to systematically develop students' knowledge of Yi patterns, colors, and vessel forms, laying a solid basis of accurate terminology and coherent cultural narratives. In terms of technical competence, the course follows the logic of craft acquisition, strengthening lacquer preparation, substrate fabrication, and lacquering techniques in stages, thereby enhancing students' practical ability to match techniques with forms in their creations. In terms of project awareness, micro-projects are used to replace single assignments, guiding students through the full process from topic selection, design, and making to presentation and reflection, and shaping their systematic thinking in problem definition and scenario setting. In terms of innovation and entrepreneurship capability, group collaboration and presentations are used to cultivate students' division of labor, cooperation, and resource integration abilities, and to stimulate feasible ideas with the potential to develop into innovation and entrepreneurship projects. In this way, the course is transformed from a platform for single-skill training into one for comprehensive competence development, and the direction for systematic optimization of teaching strategies is clarified.

Based on the newly constructed objective framework, the course structure has been upgraded from a linear model combining theory and practice to a spiral, progressive pathway progressing from in-class incubation to extracurricular training and then to competition-based validation. In class, with Yi lacquer art as the theme, students are organized into groups to complete micro-projects that cover topic selection, research, design, making, and reflection, thereby achieving project-based learning and operation at the classroom level. In the extracurricular stage, teams with outstanding performance are encouraged to integrate their course outcomes and, under teacher guidance, apply for university-level or higher innovation and entrepreneurship projects, gaining richer resources to deepen practical exploration. Mature projects may be recommended to participate in various design and innovation and entrepreneurship competitions, using broader social evaluation to validate and optimize the projects and feeding back cases to course teaching. This structure effectively connects course learning, project practice, and outcome presentation, forming a continuous development pathway from classroom work to innovative achievements.

4. Teaching strategies and implementation pathways

Based on the reconstructed objective framework and course structure, teaching strategies have been comprehensively adjusted from four dimensions: task design, teaching rhythm, assessment methods, and university–local collaboration.

In terms of task design, the course adopts a problem-oriented approach and replaces traditional assignments with micro-projects. Students are guided to complete the full process from theme definition, data collection, and scheme design to production, implementation, and reflective presentation around concrete objects. For

example, in the task “Contemporary Expression of Yi Lacquer Jewelry,” students must identify target users and usage scenarios, develop multiple design schemes via literature and artifact research, select the best scheme for production, systematically record craft difficulties, and articulate design logic and directions for optimization in their presentations. In this way, they experience the full cycle of a real project within the classroom.

The teaching rhythm is organized according to project progress. In the early stage, lectures focus on Yi lacquer culture and typical cases. In the middle stage, training in material formulation and technical processes is emphasized to consolidate operational foundations. In the later stage, attention is shifted to project advancement, with most class time devoted to group discussions, interim reports, and on-site teacher guidance. This design ensures both the systematic learning of techniques and the continuity of project progress, helping students complete the full loop from research to final products within limited class hours.

Assessment methods are constructed along three dimensions: process, outcomes, and potential. Process assessment focuses on the depth of research, quality of project logs, and interim design schemes. Outcome assessment emphasizes craftsmanship, form and color performance, and accuracy in the use of cultural symbols. Potential assessment concentrates on the clarity of target user positioning, possibilities for series expansion, cost awareness, and feasibility of applying for innovation and entrepreneurship projects. Assessment results serve as an important basis for recommending projects for further development, thus effectively linking course learning with innovation and entrepreneurship practice.

In addition, the course actively expands platforms for university–local collaboration. By cooperating with Yi lacquerware workshops and other intangible cultural heritage institutions, students are provided with opportunities for on-site research and craft prototyping. At the same time, resources from the university’s innovation and entrepreneurship college and enterprise mentors are introduced to provide professional guidance on business model building and promotion strategies. As a result, some classroom projects can continue to be developed after the course ends and enter broader application and practice fields.

5. Case analysis of national-level innovation and entrepreneurship projects

Under the support of this curriculum reform framework, several innovation and entrepreneurship projects in lacquer art have been approved in succession, among which two national-level projects were rated “excellent” and “good” upon completion. The following sections analyze the generation and implementation of these projects.

5.1. “Fire and Tiger” Yi lacquerware tea set project (Rated Excellent)

This project originated from the course unit “Regional Culture-Themed Vessel Design.” Based on the cultural connotations of “fire” as a symbol of reunion and “tiger” as a guardian totem in Yi culture, the team proposed the design concept of “gathering people by fire and guarding vessels by tigers.” At the course stage, the team had completed design drawings for cups, bowls, and trays that integrated flame and tiger patterns. Multiple rounds of experimentation were conducted in class on substrate selection, lacquer-layer thickness, and texture expression.

For example, a composite technique combining natural wrinkling and gold-leaf application was used for the flame and tiger patterns so that the gold leaf formed natural cracks and undulations under the tension of the lacquer layer, thereby enhancing visual layering and tactile experience. By controlling lacquer thickness and drying time, the team also improved the wear resistance of the vessels in daily use.

After project approval, the team optimized the completeness and practicality of the tea set system, designing

a combination of forms including teapots, teacups, and tea trays (**Figure 1**), and refining details such as grip comfort and capacity. Meanwhile, the project team summarized its experimental process and design practice and published an academic paper, completing a conceptual elevation from practice to theory ^[14]. The project performed well in cultural positioning, system design, and craft implementation, demonstrating the project-based support function of the course in terms of cultural and technical training.



Figure 1. Design process of the “Fire and Tiger” Yi lacquerware tea set project.

5.2. “Yi Lacquer Jewelry Series Design” Project (Rated Good)

This project originated from the course unit “From Apparel Ornaments to Object Ornaments.” Using traditional Yi headdresses and silver jewelry as prototypes, students transformed patterns and colors into lacquer jewelry, forming a series of works including the “Yi Fire Coronet” headpiece, the “Cloud Tassel Silver Scarf” hat ornament, the “Floral Star Hairpin” series, the “Flame-Ring Flow” earrings, the “Looping Yi Red” bracelet, and the “Spiral Spring Branch” hairpin (**Figures 2–5**). Under course assessment and teacher guidance, the team integrated these outcomes and applied for a national innovation and entrepreneurship project.

During implementation, the team clarified target users and usage scenarios by sorting the forms of Yi headdresses and investigating contemporary accessory needs. At the same time, targeted adjustments were made to structure and techniques, for instance, the weight of lacquer hat ornaments was reduced through segmented “detachable” hollow lacquer techniques combined with internal support rings; in the “Floral Star Hairpin” series, modular units were refined to adapt to different wearing combinations. The project received recognition from reviewers for its work on extracting ethnic cultural elements, serial design, and craft implementation, and reflected the positive effect of project-based course design in cultivating students’ abilities in problem analysis, user research, and team collaboration.



Figure 2. “Yi Fire Coronet” headpiece series. Camellias and butterflies are blended with fiery hues, symbolizing light and ceaseless vitality.



Figure 3. “Cloud Tassel Silver Scarf” hat ornament series. A rice-grain texturing technique is used to form floral motifs, while silver ornaments evoke the silhouette of wheat ears, symbolizing abundance and lightness.

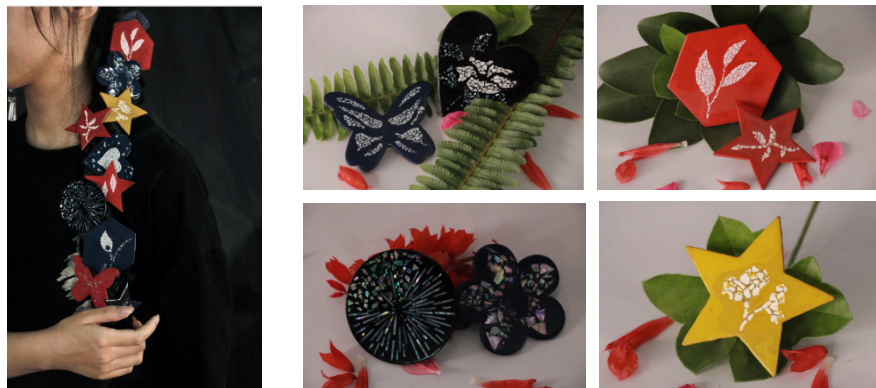


Figure 4. “Floral Star Hairpin” series. The sheen of lacquer and mother-of-pearl inlay embellishes the motifs, with silver “stars” dotted on the tips of the branches, as if quietly wearing the night in one’s hair.

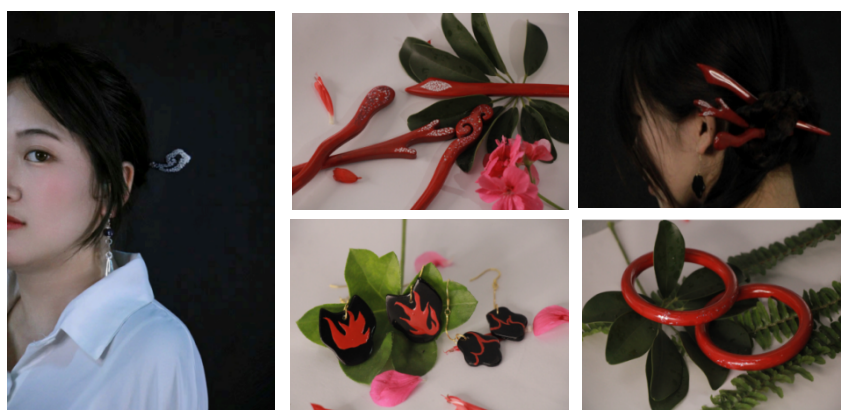


Figure 5. “Flame-Ring Flow” earrings, the lacquer hoops swaying at the ears resemble leaping flames, their flowing lines echoing ancient rhythms of life. “Looping Yi Red” bracelet, Concentric layers of red lacquer emulate traditional Yi patterns, encircling the wrist with auspiciousness and the resonance of history. “Spiral Spring Branch” hairpin, A touch of lacquer in the hair spirals upward like a newly sprouting vine, fixing in place the upward-growing posture of spring.

6. Conclusion

The project-based teaching reform of lacquer art courses oriented toward innovation and entrepreneurship transforms innovation and entrepreneurship education from an extracurricular supplement into an embedded and continuously optimized component of in-class teaching. The four-dimensional objective framework promotes a shift in the course from technique-centered training to comprehensive competence development. The spiral pathway connects classroom learning, project training, and outcome presentation, while project-based tasks, multi-dimensional assessment, and university–local collaboration provide systematic support for project incubation.

The practice of two national-level innovation and entrepreneurship projects shows that this framework not only improves students' craft skills but also strengthens their abilities in problem analysis, user insight, and team collaboration, thus effectively promoting the transformation of classroom work into high-level projects and cultural and creative products.

Future research can be deepened in several aspects: expanding the application of this model to other specialties and traditional crafts; introducing more rigorous effectiveness evaluation tools; strengthening cross-faculty collaboration and university–enterprise cooperation; and exploring the applicability of project-based teaching models in various traditional craft courses. By integrating digital technologies and social practice, lacquer art courses can further enhance their function in serving regional cultural revitalization and industrial development.

Disclosure statement

The author declares no conflict of interest.

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Deepening and Practice of Academy-System Talent Training Under the Background of Comprehensive Vocational Education Reform

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Abstract: In response to the requirements of the “typification” development of vocational education and the “integration of industry and education” reform, Shanghai Construction Management Vocational and Technical College Xuhui Campus innovatively implements the academy system management mode for five-year integrated students, focusing on four major professional groups such as “digital municipal” to build a three-dimensional education system of “cultural foundation, skill empowerment, and personality development.” At the grassroots level of cultural construction, reconstruct the general education curriculum system through hierarchical teaching, professional group-oriented curriculum modules, etc. In terms of skill empowerment, we will create an integrated training chain of “cognition training application” through the ability advancement map and workshop-based enlightenment. In terms of personality development, we rely on innovative management mechanisms such as cross-disciplinary communities and the three-track mentorship system. At the same time, we will strengthen the guarantee from five aspects, including organizational system, faculty team, and resource platform, and form a closed-loop management through dynamic quality monitoring, aiming to cultivate innovative and composite high-quality technical and skilled talents for Shanghai’s urban construction management.

Keywords: Academy system; Education management; Talent training

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1. Analysis of the current situation of academy-system education under the background of vocational education reform

Against the background of the country vigorously promoting the “typed” development of vocational education and emphasizing the reform of “integration of production and education” and “combination of education and training,” the academy system, as an innovative form of vocational education talent training model, is experiencing a development stage from exploratory pilot to gradual deepening, showing distinct characteristics of “vocational education adaptation.” Most academies are built around their core majors (such as urban construction, agricultural and animal husbandry technology, and intelligent manufacturing), realizing the binding

development of “professional group + academy”^[1-3].

Although the vocational education academy system has developed rapidly, it faces three core challenges that restrict its in-depth integration with vocational education reform:

- (1) The “vocational education attributes” of the curriculum system need to be strengthened. Some academies continue to use the general education curriculum framework of general education, with low coupling with professional skills and job needs. For example, the courses of engineering academies are not combined with vocational education scenarios, leading to the disconnection between “culture as the foundation” and “skills as empowerment.”
- (2) The “depth of school-enterprise collaboration” is insufficient. Most academies’ cooperation with enterprises remains superficial and does not involve core links. Some “industrial academies” are “in name only” due to limited enterprise resource investment and mismatched interest demands.
- (3) The “standard absence” of the evaluation system. At present, there is a lack of exclusive evaluation standards, and most institutions use traditional evaluation methods that do not include core vocational education indicators, making it difficult to accurately measure the effectiveness of talent training^[4-6].

2. Deepening “Culture as the Foundation”: Reconstructing the curriculum system to consolidate the foundation of humanities and sciences

2.1. Reform goal

Break the “general education tendency” of general courses, establish a general education system deeply coupled with professional groups, and provide solid theoretical and thinking support for skill learning.

2.2. Specific measures

- (1) Implement hierarchical teaching according to the needs of professional groups
Courses such as mathematics, physics, chemistry, and information technology establish three dimensions, basic level, improved level, and extended level, oriented by professional needs, accurately connect with majors, and optimize teaching content. Teachers undertaking different professional courses conduct in-depth research on the knowledge needs and skill requirements of each major, accurately locate the connection points between general courses and professional courses, and optimize teaching content. According to the teaching goals of different levels, select and integrate general knowledge, add professional cases and practical projects, making the teaching content more targeted and practical (**Table 1**)^[7].

Table 1. “Professional group-oriented” general curriculum modules

Professional groups	Examples of general curriculum modules	Strengthened abilities
Digital Municipal Engineering / Intelligent Construction	“Applied Engineering Mathematics”, “Basic Physics for Intelligent Construction”, “Building Information Modeling (BIM) and Data Thinking”	Mathematical modeling, mechanical analysis, data processing, etc.
Landscape Art	“Landscape Aesthetics and Art Appreciation”, “Basic Ecology”, “Plants and Environmental Chemistry”	Art appreciation and aesthetics, etc.
Smart City Management	“Logic and Communication in Urban Management”, “Basic Information Technology and Application”, “Introduction to Urban Sociology”	Information literacy and social cognition, etc.

(2) Develop cultural literacy courses with industry characteristics

Establish an interdisciplinary teacher team (such as subject teachers + industry teachers + enterprise mentors) to develop and construct cultural literacy courses with industry characteristics. For example, offer the course “Architecture and Humanities” in construction-related majors, exploring the connection between architectural functions, aesthetics, and culture through the analysis of classic cases such as the Forbidden City and the Sydney Opera House; the course “Architectural History and Craftsman Spirit” allows students to understand the industry values of “striving for excellence” through interviews with intangible cultural heritage inheritors and visits to ancient architectural restoration sites^[8].

(3) Innovate the “project-embedded” teaching model

Adopt PBL (Project-Based Learning) to integrate general knowledge into real projects. For example, in the courses of the School of Smart City Management, let students use Excel or Python to analyze campus energy consumption data and provide suggestions for energy-saving transformation; in the urban pocket park ecological restoration and community cultural integration project of the School of Landscape Technology and Art, use color psychology to design color schemes for landscape sketches.

(4) Offer combined short-term courses

Irregularly invite outstanding on-campus teachers, external industry experts, scholars, skilled craftsmen, and outstanding alumni to offer combined courses (short-term courses or lectures) for students who wish to further develop in related fields, helping them understand industry trends and realize hierarchical ability training. Students can also be organized to visit science and technology venues and red bases to cultivate their scientific literacy and patriotic feelings.

3. Strengthening “Skills as Empowerment”: Connecting training paths to achieve progressive ability development

3.1. Reform goal

Give play to the advantages of five-year consistent continuous training, systematically design skill training paths, and construct an integrated skill training chain of “cognition-training-application”^[9].

3.2. Specific measures

(1) Establish a “skill progression map”

Based on the post-ability requirements of the four major professional groups, design the five-year skill training path. Clarify that the core ability goal of the first two years at Xuhui Campus is “mastery of basic skills and vocational cognition,” and develop the Professional Skill Progression Manual, marking skill points, assessment standards, and curriculum connection relationships.

(2) Implement “workshop-style” skill enlightenment

Introduce “micro-workshop” practices in the first two years, such as the “Intelligent Construction Model Workshop,” allowing students to establish professional interests and understand principles through practice. At the same time, invite enterprise technicians and intangible cultural heritage inheritors to the academy to set up “master workshops” to pass on the craftsman spirit and cutting-edge technologies.

(3) Establish professional associations integrating training and competitions

Set up professional associations at Xuhui Campus, connecting with skill competitions at all levels. Build a “trinity” teaching model based on classroom teaching, supported by association training, and driven

by skill (discipline) competitions, forming a three-level progression system, and realizing the efficient training of skilled talents through “learning by doing and practicing by competing.”

4. Promoting “Personalized Development”: Innovating academy management to help students’ all-round growth

4.1. Reform goal

Construct a tutor system led by Party building, paired co-construction, and collaborative education, as well as a student-oriented, peer-assisted autonomous management system. Relying on the “Yunxin Workshop” Party-mass comprehensive activity center, give play to the advantages of the academy system’s living community, build an interdisciplinary communication platform, stimulate students’ potential, and promote their all-round growth^[10].

4.2. Specific measures

(1) Create an “interdisciplinary learning and living community”

Form interdisciplinary learning groups based on interests, such as “Smart City Construction”. Carry out learning salons and student activities relying on the “Yunxin Workshop” Party-mass comprehensive activity center, encouraging students from different majors to conduct interdisciplinary discussions and creative designs around real issues such as urban governance^[11].

(2) Implement a three-track parallel education mechanism of “class teacher + career tutor + growth mentor”

On the basis of the daily management of class teachers in the academy system, assign career tutors to students through Party building joint construction in accordance with the principle of “two-way selection and allocation on demand”. Tutors comprehensively guide and instruct students to achieve the goal of “promoting students’ all-round development”^[12].

(3) Implement the “2+1” model for growth mentors in the academy system

Two senior students (one from the second grade of Xuhui Campus and one from the senior grade of Qingpu Campus) are paired by major to help one freshman dormitory. Growth mentors pay attention to the living adaptation of guided students and guide emotions and values through “peer tutoring”.

(4) Construct a “digital portrait” evaluation system

Use information technology to record students’ performance in skill learning and other aspects, generating a “student growth digital portrait.” The evaluation dimensions include “skill level,” providing data support for students’ personalized development.

5. Guarantee measures

5.1. Organizational and institutional guarantee

(1) Establish a special leading group

Led by college leaders, composed of the heads of the Academic Affairs Office, Student Affairs Office, secondary colleges of each major, and the Basic Teaching Department. Clarify the division of responsibilities of each department, hold regular joint meetings to coordinate and solve key issues such as resource allocation and progress promotion.

(2) Improve the institutional support system

Formulate guiding documents such as the Standards for the Construction of General Courses in the

Academy System, Measures for the Management of Skill Workshops, and Assessment Rules for Career Tutor Work, clarifying the implementation norms for measures such as hierarchical teaching, project-embedded teaching, and digital portrait evaluation; establish a “three-dimensional education” effectiveness evaluation mechanism, incorporating indicators such as students’ skill certificate acquisition rate, interdisciplinary project participation, and enterprise satisfaction into the annual assessment, ensuring that the reform has rules to follow and achieves tangible results^[13].

5.2. Teacher and team guarantee

(1) Deepen the training of “double-qualified” teachers

Implement the “Teacher Enterprise Practice Program,” requiring general course teachers and professional teachers to jointly participate in enterprise projects (such as BIM technology application, smart city management case development) to improve practical teaching capabilities; introduce industry technical backbones, intangible cultural heritage inheritors, engineering masters, etc., as part-time teachers, and form “interdisciplinary teaching teams” (such as “Engineering Mathematics + BIM Technology” and “Landscape Aesthetics + Ecology” combinations) to jointly develop curriculum modules and practical projects^[14].

(2) Strengthen the construction of the tutor team

Establish a training system for “class teachers - career tutors - senior tutors,” regularly carry out special training on career planning guidance, interdisciplinary communication skills, mental health education, etc.; set up a “tutor development fund” to support tutors to participate in industry seminars and teaching innovation research projects, improving their guidance capabilities and professional vision.

5.3. Resource and platform guarantee

(1) Optimize the allocation of teaching resources

Increase resource investment in hierarchical teaching and project-based learning, build a “professional group-oriented” general course resource library (such as engineering mathematics case library, landscape aesthetics digital resource platform); upgrade laboratory and workshop facilities, equipped with cutting-edge tools such as BIM software, intelligent surveying and mapping equipment, and ecological simulation systems, meeting the practical needs of “micro-workshops” and “master workshops.”

(2) Deepen school-enterprise collaborative education

Co-build “practical teaching bases” with leading enterprises in Shanghai’s urban construction, landscape design, smart city and other fields, introducing real enterprise projects (such as campus energy consumption analysis, community pocket park design) as students’ practical topics; jointly set up “skill scholarships” and “innovation project incubation funds” with enterprises to encourage students to participate in skill competitions and entrepreneurial practices.

(3) Build an interdisciplinary communication platform

With the “Yunxin Workshop” Party-mass comprehensive activity center as the core, build an online “smart academy” platform, integrating information on interdisciplinary learning groups, community activities, industry lectures, etc., to realize resource sharing and activity reservations; regularly organize “enterprise open days” and “industry carnivals”, inviting experts from different fields to communicate face-to-face with students to broaden their professional horizons^[15].

5.4. Funding and incentive guarantee

First, increase investment in educational funds to strongly support curriculum development, workshop construction, tutor subsidies, student innovation projects, etc. Second, implement diversified incentive measures. Teachers who participate in hierarchical teaching reform and develop interdisciplinary curriculum modules will be given preferential treatment in professional title evaluation and teaching achievement award selection; students who perform outstandingly in skill competitions and interdisciplinary projects will be given priority in recommending internships, enterprise scholarships, and included in the “innovative thinking” dimension of the “digital portrait” evaluation system, linked to further education and employment recommendations.

5.5. Quality monitoring and feedback guarantee

(1) Establish a dynamic monitoring system

Use the “student growth digital portrait” platform to real-time track students’ performance in general course learning, skill training, and community activities, and regularly generate “talent training quality analysis reports” to provide data support for curriculum adjustment and tutor guidance optimization.

(2) Smooth feedback channels

Conduct student forums, career tutor and growth tutor evaluation meetings, and graduate follow-up surveys every semester to collect opinions and suggestions on curriculum content, skill training, and management services; set up an “academy reform suggestion box” to encourage teachers and students to participate in the optimization of the education system, forming a closed-loop management of “practice-feedback-improvement.”

6. Conclusion

Facing the future, the academy system of Xuhui Campus will always take “serving urban construction and cultivating industry newcomers” as its mission. By consolidating the humanistic foundation, strengthening the skill core, and stimulating personalized potential, it not only helps students achieve a smooth transition from “campus people” to “professional people” but also cultivates their lifelong learning abilities and social responsibility, delivering “technically proficient, culturally accomplished, and innovative” high-quality talents for Shanghai and even the national urban construction field.

Disclosure statement

The author declares no conflict of interest.

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Research on the Construction of Curriculum Ideological and Political Education in Higher Vocational Physical Education Major

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Abstract: Curriculum ideological and political education is a key measure to implement the fundamental task of fostering virtue through education. As a cradle for cultivating future sports technical talents and professional qualities, the construction of curriculum, ideological and political education in higher vocational physical education majors plays a pivotal role in shaping students' sound personalities and cultivating their professional spirits. Therefore, this paper takes the curriculum ideological and political education of higher vocational physical education majors as the starting point, analyzes the current problems existing in the development of curriculum ideological and political education in these majors, and puts forward some practical methods and suggestions, such as excavating ideological and political elements to enrich teaching content, updating teaching methods to strengthen educational effects, and improving evaluation systems to optimize assessment mechanisms. Thus, it promotes the integration of physical education and ideological and political education, and cultivates more craftsman-type talents with exquisite professional skills and profound patriotic feelings for the country.

Keywords: Higher Vocational Education; Physical Education Major; Curriculum Ideological and Political Education

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1. Introduction

The direction of education reform in the new era is to implement the fundamental task of fostering virtue through education and cultivate socialist builders and successors with all-round development of morality, intelligence, physical fitness, aesthetics, and labor. Curriculum ideological and political education is a new type of education method that integrates ideological and political education into various curriculum teachings. It breaks the previous dilemma of "two skins" between ideological and political education and professional course teaching, and becomes an important path to realize "all-staff education, all-process education, and all-round education." The goal orientation of higher vocational physical education majors is to cultivate applied talents such as primary and secondary school physical education teachers and social sports instructors. Its curriculum system has strong

practical, technical and humanistic characteristics, which endows the major with unique curriculum ideological and political resources, from the spiritual core extracted from traditional Chinese sports culture, to the will quality tempered in the process of sports training, and then to the team spirit and rule awareness displayed in sports competitions, all of which are good carriers for carrying out curriculum ideological and political education. Exploring how to effectively implement the construction of curriculum ideological and political education in higher vocational physical education majors is not only a response to the requirements of the national education policy, but also a specific starting point for improving the quality of talents.

2. Significance of the construction of curriculum ideological and political education in higher vocational physical education majors

2.1. Inherent requirement for implementing the fundamental task of fostering virtue through education

Fostering virtue through education is the fundamental task of education, and its essence is to cultivate “new people of the times with both virtue and ability, and virtue first”. The future jobs of higher vocational physical education majors are engaged in sports teaching, fitness guidance and other professional work, and their words and deeds will have a demonstration effect on students’ formation of values^[1]. The construction of curriculum ideological and political education can integrate socialist core values, professional ethics, family and country feelings and other contents into the teaching process of sports skills courses, so that students can deeply understand the value logic behind concepts such as “health first,” “fair competition” and “solidarity and cooperation” while learning and mastering sports skills, realizing the integration of skills and morality, and the simultaneous cultivation of morality and skills. For example, integrating the Olympic spirit of “Faster, Higher, Stronger—Together” into track and field teaching can guide students to break through the limitations of individual competitions and establish a sense of collective honor and social responsibility; explaining “stopping warfare as martial arts” and “great chivalry” in traditional martial arts teaching helps students understand the peace gene and sense of responsibility in excellent traditional Chinese culture^[2].

2.2. Key path to improve the educational effectiveness of physical education majors

The traditional physical education teaching mode focuses on the standardized training of technical movements, while neglecting the shaping of students’ ideological character. The construction of curriculum ideological and political education reconstructs the teaching content and methods, turning ideological and political education from an “additional link” into an “inherent element”, thus making the education process more permeable and appealing^[3]. On the one hand, when learning and mastering sports skills, students will always encounter physical fatigue, psychological setbacks and other situations, which involves cultivating the will quality of perseverance and never giving up; on the other hand, the existence of group sports such as team projects and competitive games provides a real scene for cultivating rule awareness, cooperative spirit and anti-frustration ability^[4]. For example, when organizing group competitions in basketball teaching, teachers can emphasize the cooperative spirit of “trusting teammates and obeying the overall situation” through tactical cooperation, explain the sportsmanship of “respecting rules and fair competition” by using penalty disputes, and turn ideological and political education from empty preaching into vivid experience, which greatly improves the educational effect.

2.3. Important carrier for inheriting traditional Chinese sports culture and cultivating cultural confidence

Traditional Chinese sports culture has a long history, from the “Six Arts” in the pre-Qin period to the blooming of martial arts schools in the Ming and Qing dynasties; from traditional health-preserving techniques such as Tai Chi and Baduanjin to modern national traditional sports events such as dragon dancing and shuttlecock kicking. All of them contain the philosophical wisdom and spiritual pursuit of the Chinese nation^[5]. Higher vocational physical education majors are the main positions for spreading sports culture. The construction of curriculum ideological and political education can sort out the ideological and political elements contained in these cultural resources: the philosophical thought of “overcoming hardness with softness and balancing yin and yang” emphasized in Tai Chi can be extended to dialectical thinking and the ecological concept of harmonious coexistence; the “mutual assistance and striving for excellence” in dragon boat racing customs can also interpret the contemporary value of collectivism and patriotic feelings^[6]. Integrating such cultures into teaching can not only enhance students’ sense of national cultural identity but also give play to the function of “educating people through culture”, cultivate cultural confidence, and promote the creative transformation and innovative development of excellent traditional Chinese culture.

3. Practical countermeasures for the construction of curriculum ideological and political education in higher vocational physical education majors

3.1. Deeply excavate ideological and political elements to enrich teaching content

Firstly, focus on curriculum modules and excavate ideological and political elements by classification. According to the core courses of physical education majors, combined with the teaching objectives and content characteristics of each module, accurately extract ideological and political elements^[7]. For example: Track and Field Course: excavate the marathon spirit of “persisting to the end”, the sense of competition rules of “fair competition,” and the challenging spirit of “surpassing oneself”; Martial Arts Course: refine the martial ethics norms of “valuing martial arts and emphasizing virtue”, the traditional health-preserving wisdom of “harmony between man and nature”, and the national spirit of “self-improvement”; School Physical Education Course: integrate the teacher’s mission under the background of the “Healthy China” strategy, the educational concept of “student-oriented”, and the practical path of “simultaneous development of five educations”; Sports Training Course: emphasize the scientific and rigorous training attitude, the educational wisdom of “teaching students in accordance with their aptitude”, and the competitive ideal of “winning glory for the country”.

Secondly, link current political hotspots to strengthen the integration of contemporary themes. Combine major national strategies such as “Healthy China 2030”, “integration of sports and education”, “national fitness,” as well as major sports events such as the Winter Olympics and Asian Games, and transform contemporary propositions into teaching cases. When explaining the “sports industry”, the concept of “green Olympics” in the Beijing Winter Olympics can be introduced to analyze the application of technological innovation and sustainable development in sports; when talking about “school physical education”, combine the sports after-school service activities carried out under the current “double reduction” policy to make students think about the sense of responsibility they shoulder as future physical education teachers^[8]. Enhancing the contemporary nature of classroom teaching through current political hotspots can also cultivate students’ family and country, and social responsibility.

Thirdly, rely on local resources to highlight regional characteristics. Incorporate local traditional sports cultural resources (ethnic minority sports projects, regional characteristic martial arts schools) into teaching content. For example, higher vocational colleges in Yunnan can introduce Dai peacock boxing and “Yi Damo Qiu”

(a traditional Yi sport), and talk about the national history and ecological protection concepts behind them while explaining movement techniques ^[9]; higher vocational colleges in Shandong can connect with Cujia culture to clarify the inheritance relationship between ancient sports and modern football. The integration of local resources can enrich teaching content and arouse students' sense of local identity and cultural pride. Teaching methods are the "bridge" for the implementation of curriculum, ideological and political education. Higher vocational physical education majors should break the traditional skill teaching mode of "teacher demonstration—student imitation," and build a diversified teaching method system of "situational immersion, practical experience and digital empowerment", so that ideological and political education can be carried out "silently" ^[10].

3.2. Innovate teaching methods to enhance educational effects

(1) Situational Teaching Method: Create immersive educational scenes

With the help of simulating real situations or reproducing historical events, let students experience the connotation of ideological and political education through physical participation ^[11]. For example, in the teaching of "sports game compilation", assign the task of "red-themed sports meeting", requiring students to design games based on historical backgrounds such as the rapid march on the Long March and the Nanniwan reclamation, taking into account interestingness, educational significance and safety issues. In the process of consulting historical materials, formulating rules and implementing them, students can deepen their understanding of the revolutionary spirit, and exercise their innovative awareness and social responsibility. In addition, VR technology can be used to reproduce classic sports event scenes (such as the opening ceremony of the 2008 Beijing Olympics), allowing students to personally experience the moment of China's sports rise, thereby stimulating national pride.

(2) Practical Experience Method: Strengthen the educational logic of integrating knowledge and practice

The practical characteristics of physical education determine that "learning by doing and comprehending by learning" is the best educational method. Teachers can design dual-target teaching tasks of "skills + ideological and political education", allowing students to reflect on the value implications in practice ^[12]. For example, when carrying out "outward bound training", set up projects such as "trust fall" and "high-altitude broken bridge", requiring students to complete them in groups and talk about their feelings: experience "responsibility and commitment" through "trust fall", and perceive "breaking through fear and challenging oneself" through "high-altitude broken bridge". Students can also be organized to participate in community sports services (such as fitness guidance for the elderly and sports teaching support for left-behind children), and practice the volunteer spirit of "dedication and fraternity" in the process of helping others, realizing the unity of "skill output" and "value internalization" ^[13].

3.3. Improve the evaluation system and optimize the assessment of curriculum ideological and political education

(1) Optimize evaluation indicators and highlight ideological and political dimensions

On the basis of the original skill assessment (such as the standardization of movements and compliance results), add evaluation indicators for ideological and political literacy, including:

- (A) Learning Attitude: whether actively participating in classroom ideological and political discussions and taking the initiative to reflect on the value connotation behind skills;
- (B) Teamwork: whether embodying the spirit of tolerance and mutual assistance in group projects and being able to properly handle differences;

- (C) Professional Ethics: whether abiding by teachers' ethics and norms in simulated teaching or internships (such as protecting students' safety and respecting individual differences) ^[14];
- (D) Innovative Awareness: whether being able to innovate teaching designs by combining ideological and political elements (such as integrating red culture into physical education lesson plans).
- (2) Innovate evaluation methods and focus on process records
- Adopt the method of "quantitative + qualitative" and "self-evaluation + mutual evaluation + teacher evaluation" to comprehensively record the development track of students' ideological and political literacy. Establish a "curriculum ideological and political growth file bag" to collect students' classroom speech records, practical reflection logs, volunteer service certificates, teaching design plans and other materials; use the "360-degree evaluation method" to invite students to evaluate each other's teamwork and practice units to assess professional ethics ^[15]. Use big data to analyze students' frequency of participating in ideological and political topic discussions on online platforms and the duration of watching micro-lectures, as supplementary references for process evaluation.
- (3) Strengthen the application of results and give play to the guiding role
- Link the assessment results of curriculum ideological and political education with academic evaluation, selection of excellent students and professional development. For example, stipulate that students whose ideological and political literacy fails to meet the standards must participate in the "ideological and political supplementary training workshop"; take ideological and political performance as the main indicator when selecting "excellent interns" and "teaching skills competitions"; invite enterprise tutors to participate in defense reviews, focusing on examining students' comprehensive abilities of "excellent skills and qualified teachers' ethics". Through the application of results, students are urged to attach importance to ideological and political learning, realizing "promoting construction and reform through evaluation".

4. Conclusion

In summary, the construction of curriculum ideological and political education in higher vocational physical education majors is systematic, and its core is to promote the integration of education and the teaching of sports skills, and the coordination of educating people through physical education and educating people through culture. In response to the development requirements of vocational education, higher vocational colleges need to pay attention to strengthening top-level design, effectively improve system guarantees, and promote the implementation of curriculum ideological and political education, to cultivate physical education talents who master sports skills and have good psychological quality, and contribute to the construction of a sports power.

Disclosure statement

The author declares no conflict of interest.

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Exploration and Practice of Integrating Cultural Confidence into Higher Vocational English Teaching: Based on Textbook Supply-Side Reform Under the Background of Curriculum Ideological and Political Education

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Abstract: Against the strategic background of comprehensively promoting curriculum ideological and political education and implementing cultural confidence, higher vocational English teaching faces practical challenges such as fragmented cultural education content and rigid integration methods. Taking the “Practical English for Higher Vocational Education in the New Era” series textbooks co-edited by the authors as a practical case, this paper systematically elaborates an integration path of cultural confidence centered on “textbook supply-side reform”. The study proposes that through systematic content supply, the textbooks construct a three-dimensional content system with Chinese feelings and an international perspective as the dual-core guidance, organically integrating three major cultural connotations. Through innovative method integration, they practice a “learning by doing” teaching model supported by a task-driven approach, school-enterprise dual cooperation, and multimodal resources. Practice has proved that this reform effectively realizes the in-depth integration of cultural education and language teaching, provides a referenceable textbook paradigm for cultivating high-quality technical and skilled talents needed in the new era, and is a beneficial exploration and positive response to implementing the fundamental task of fostering virtue through education in higher vocational English teaching.

Keywords: Cultural confidence; Higher vocational English; Curriculum ideological and political education; Textbook construction; Action orientation

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1. Introduction

The “Guidelines for the Construction of Curriculum Ideological and Political Education in Colleges and Universities” clearly points out that to implement the fundamental task of fostering virtue through education, it

is necessary to integrate value shaping, knowledge impartment, and ability training into one^[1]. The “Curriculum Standards for English in Higher Vocational Education (2021 Edition)” (hereinafter referred to as the “Standards”) also emphasizes that English courses should strive to cultivate “high-quality technical and skilled talents with Chinese feelings and international perspective, who can communicate effectively in English in daily life and the workplace”^[2]. However, in practical teaching, the integration of cultural confidence often faces two major dilemmas: first, insufficient and fragmented content supply, where cultural materials often appear sporadically as attachments to language points, lacking systematicness; second, rigid and explicit integration methods, where forced indoctrination is difficult to resonate with students, resulting in poor educational effects. Essentially, this reflects a mismatch between supply and demand in teaching resources and methods^[3].

To address these issues, the research team led by the authors has carried out “supply-side reform” practice centered on textbooks under the guidance of research projects, with the core achievement being the compilation and publication of the “Practical English for Higher Vocational Education in the New Era” series. Fully implementing the spirit of the 20th National Congress of the Communist Party of China, these textbooks aim to explore an effective path for integrating cultural confidence into higher vocational English teaching through systematic content reconstruction and method innovation. This paper will elaborate on this practical exploration in detail from the aspects of textbook compilation philosophy, content supply, method innovation and value reflection.

2. Systematic supply: Constructing a content system for integrating cultural confidence

As the core carrier of teaching, the top-level design of textbooks directly determines the effect of integrating cultural confidence^[4]. Traditional practices often treat cultural content as appendages to language points or after-class supplements, leading to fragmented and superficial cultural teaching. Abandoning the simple “labeling” method, the “Practical English for Higher Vocational Education in the New Era” has made systematic planning from the beginning of compilation, constructing a multi-level, three-dimensional cultural content system that meets the cognitive and career development needs of higher vocational students. Guided by a clear philosophy, this system organically integrates the three connotations of cultural confidence into the entire process of language learning through modular columns.

2.1. Top-level design: Dual-core guidance of Chinese feelings and international perspective

Effective educational practice cannot do without scientific top-level design. In the “Preface”, the textbooks clearly state the mission of “cultivating talents for the Party and the country”, aiming to promote the comprehensive development of students’ core academic literacy, with special emphasis on fostering Chinese feelings and an international perspective. These two “cores” form the coordinate axis of cultural identity: Chinese feelings, as the vertical axis, guide students to explore the national spirit and establish cultural subjectivity; international perspective, as the horizontal axis, promotes students to achieve cultural mutual learning in the global context and understand cultural diversity and commonality. This design grasps the dialectical relationship of cultural confidence, confidence stems from inclusiveness and comparison^[5].

Under the guidance of this coordinate axis, the unit themes of the textbooks are closely aligned with the three categories in the “Standards”: “Career and Individual,” “Career and Society,” and “Career and Environment,” forming a progressive sequence from the individual to the collective. For example, the themes

gradually transition from “College Life” and “Job Hunting” to “Craftsman Spirit” and “Workplace Culture,” and then to “Green Development” and “New Era.” This arrangement internalizes cultural confidence into students’ development needs, guiding them to align their personal ideals with the country’s future.

2.2. Organic integration of three connotations: Constructing a hierarchical and interconnected cultural content matrix

Cultural confidence is a concept with rich connotations, including three levels: excellent traditional Chinese culture, revolutionary culture, and advanced socialist culture^[6]. Through carefully designed characteristic modules, the textbooks do not mechanically separate but organically integrate these three connotations, constructing a hierarchical and interconnected cultural content matrix (Table 1).

Table 1. Integration matrix of the three connotations of cultural confidence in textbooks

Cultural Connotations	Textbook Integration Modules	Specific Examples and Teaching Objectives	Value Guidance
Excellent Traditional Chinese Culture	1. Lead-in (Task 1): Ancient Proverb Matching 2. Appreciating Diverse Cultures: Tell China’s Story	Example: U1 Lead-in: “A young idler, an old beggar” Objective: Embed cultural genes at the starting point of language learning and inherit wisdom in subtle ways	Promote traditional wisdom, enhance historical awareness and cultural heritage
		Example: U3 of Volume 2 introduces Tai Chi; U4 of Volume 2 introduces hot pot Objective: Showcase dynamically inherited traditional culture and highlight its contemporary value and life charm	
Revolutionary Culture & Advanced Socialist Culture	1. Theme Reading / Career Reading 2. Appreciating Diverse Cultures: Tell China’s Story 3. Think Critically	Example: Reading text “Great Power Craftsman: Li Kaijun” in U4 of Volume 1; Story of Huang Wenxiu in U2 of Volume 1 Objective: Concretely interpret spirits such as dedication, struggle, and innovation through stories of role models and advanced figures of the times	Continue the red bloodline, identify with core socialist values, and establish professional role models
		Example: Think Critically sessions conduct discussions on topics such as the report to the 20th National Congress of the Communist Party of China and technological self-reliance Objective: Guide critical thinking, combine national development policies with personal reflections, and realize value internalization	

2.2.1. Infiltration of excellent traditional Chinese culture: From ancient proverbs to new stories

The integration of traditional culture in the textbooks goes beyond symbolic display, focusing on subtle infiltration. Task 1 in the “Lead-in” section of each unit is designed as “matching given English sentences with corresponding ancient Chinese proverbs,” such as “Where there is a will, there is a way.” This design places Chinese and Western cultures in dialogue at the beginning of the unit, guiding students to experience common philosophies and Chinese wisdom through language comparison.

More uniquely, the “Tell China’s Story” section under the “Appreciating Diverse Cultures” module breaks the previous practice of only introducing historical sites and delves into new-era stories. For example, Unit 4 of Volume 1 connects traditional craftsman spirit with the pursuit of contemporary manufacturing through the story of great power craftsman Li Kaijun; Unit 7 of Volume 2 showcases the “Sunway TaihuLight” supercomputer,

reflecting Chinese wisdom in modern science and technology. These contents link the past and the present, making traditional culture no longer a static exhibit but a dynamic resource full of vitality.

2.2.2. Manifestation of revolutionary culture and advanced socialist culture: Learning from role models and engaging in critical thinking

The textbooks manifest these cultures through two main approaches: role model narratives and thematic critical thinking. In the “Tell China’s Story” section, the textbooks select role models of the new era, such as Huang Wenxiu, winner of the “July 1st Medal” (Unit 2 of Volume 1), and Yuan Longping, the “Father of Hybrid Rice” (Unit 5 of Volume 1). Their stories are the continuation of the revolutionary spirit in peacetime and vivid manifestations of advanced socialist culture, which can inspire students’ admiration and willingness to learn.

The “Think Critically” section guides students to discuss topics such as green development and the community with a shared future for mankind from documents, including the report to the 20th National Congress of the Communist Party of China. This design goes beyond simple value indoctrination, aiming to cultivate students’ logical and critical thinking abilities. In the process of collecting data, organizing viewpoints and expressing themselves, students will inevitably conduct in-depth reflections on the value orientations behind the topics, thereby achieving rational identification and active acceptance of advanced socialist culture.

2.3. International comparison: Deepening cultural identity from the perspective of the “belt and road”

The establishment of cultural confidence needs to be achieved through openness and comparison^[7]. The textbooks ingeniously set up the “Get to Know the Belt and Road Country” section, systematically introducing one country along the “Belt and Road” in each unit, such as Thailand, Pakistan, Greece, Russia, Iran, and Egypt. This design has dual meanings: first, it serves the cultivation of students’ international perspective, enabling them to understand diverse cultures and lay a foundation for future workplace foreign-related communication; second, and more importantly, it provides a “other” mirror for students to deepen cultural identity. By understanding the history, culture, customs and development status of countries along the route, students can conduct intuitive comparisons in cultural mutual learning, thereby more clearly recognizing the uniqueness of Chinese culture, the rationality of China’s development path, and the inclusiveness and sharing of China’s “Belt and Road” initiative. This helps them consolidate the awareness of a community with a shared future for mankind, making their cultural confidence based on a more open, inclusive and rational foundation rather than narrow nationalist sentiments^[8].

3. Innovative integration: Exploring methodological paths for cultural confidence teaching

High-quality content systems are like rootless trees if they cannot be effectively delivered to students. To ensure that cultural confidence can be quietly internalized into students’ value identification and behavioral awareness, the “Practical English for Higher Vocational Education in the New Era” has carried out systematic innovations in teaching methods, breaking the stereotype of cultural indoctrination in traditional language teaching and constructing an integration path centered on “student-oriented, action-guided, and technology-empowered”^[9].

3.1. Task-driven approach and constructivism: realizing value internalization in “Learning by Doing”

Following the compilation logic of “theme as the thread, activity-oriented, and task-driven,” the textbooks are based on constructivist learning theory, emphasizing that knowledge is actively constructed in contexts^[10]. This concept is concentrated in the “Unit Project” section. Instead of scattered language exercises, this section designs comprehensive, output-oriented tasks with challenges and authenticity around unit themes. For example, after learning the “Craftsman Spirit” unit, the project task is “Work in groups to share craftsmen’s stories”; after the “Innovation and Entrepreneurship” unit, the task is “Work in groups to make a career plan.”

These tasks create a nearly real micro-social context, requiring students to go through the entire process from information collection, screening and integration to planning, creation and presentation in the form of group cooperation. In this process, students’ understanding of values such as craftsman spirit and innovation awareness no longer relies on mechanical memory but is actively constructed in the practice of solving problems. To tell craftsmen’s stories well, they need to deeply understand the spirit behind the characters; to formulate career plans, they need to combine personal ideals with social needs. By decomposing task steps and building “scaffolds”, the textbooks guide inquiry-based learning, practice the action-oriented concept of vocational education, and realize the transformation of cultural confidence education from knowledge to action^[11].

3.2. School-enterprise dual development: Anchoring cultural values in real workplace contexts

The vocational nature of higher vocational education requires that cultural confidence education must be closely linked to students’ future career development^[12]. The textbooks adopt a school-enterprise dual cooperation development model, where enterprise experts deeply participate in the creation of workplace contexts and the provision of real corpora, closely connecting cultural confidence education with career development. This authenticity is reflected in the “Career Reading” and “Practical Writing” sections. The workplace reading covers a variety of genres, including “Recruitment Notice,” “Employment Contract,” “Product Description,” and “Medicine Package Insert”. Practical writing directly corresponds to core workplace skills, such as writing “Résumé,” “Cover Letter,” and “Meeting Minutes.”

Cultural values are thus contextualized and functionalized. For example, when learning employment contracts, honesty and keeping promises become professional requirements for safeguarding rights and avoiding risks; when writing company profiles, promoting craftsman spirit and innovation awareness become elements to enhance corporate image and competitiveness. This transforms literacy such as integrity, responsibility and collaboration from external moral norms into essential abilities related to students’ career development, enhancing the practicality and persuasiveness of cultural confidence education^[13].

3.3. Integration of multimodal resources: Activating learning experience with digital means

Facing higher vocational students who are digital natives, traditional single-paper textbooks can no longer fully meet their learning needs^[14]. The textbooks construct a three-dimensional learning system of “paper textbooks + digital resources,” realizing multi-sensory presentation of cultural content through digital courses, micro-lectures and QR codes embedded in textbooks. For example, in the “Tell China’s Story” section, students can scan QR codes to watch short videos about Saihanba, intuitively feeling the shock of the green miracle, thereby generating strong emotional resonance with the arduous pioneering spirit and the ecological concept of “lucid waters and

lush mountains are invaluable assets.” Similarly, through watching animated explanations of the “Micius” quantum satellite, abstract high-tech achievements become understandable and perceptible.

This multimodal design not only conforms to the cognitive characteristics of higher vocational students who prefer audio-visual and interactive learning, effectively enhancing learning interest and solving the potential tediousness of cultural content, but also expands the depth and appeal of cultural expression, making the narration of Chinese stories more vivid. Digital means transforming the integration process of cultural confidence from static text reading to a dynamic experience, achieving the educational effect of teaching through fun and nourishing the heart silently ^[15].

4. Conclusion

The compilation and publication of the “Practical English for Higher Vocational Education in the New Era” is a key step in transforming research from theoretical conception to practical application. It is not only a teaching tool but also a successful practice of textbook supply-side reform. Its value is mainly reflected in the following aspects:

- (1) It realizes the systematization and structuring of integrating cultural confidence. Through top-level design, the textbooks construct a cultural main line running through 16 units in 2 volumes, solving the problem of fragmented content and forming a replicable content system framework.
- (2) It explores a model of in-depth integration of cultural education and language teaching. Through methods such as a task-driven approach, situational creation and digital empowerment, value guidance is seamlessly embedded in language skill training, realizing the unity of explicit and implicit education and responding to the methodological problem of “how to integrate.”
- (3) Textbook construction is a continuous and dynamic process. In the future, empirical research on teaching effects based on the textbooks can be further carried out, the digital resource library can be continuously updated, and supporting teachers’ books can be developed to provide support for teaching practice on a larger scale.

In summary, the supply-side reform path exemplified by the “Practical English for Higher Vocational Education in the New Era” proves that through systematic content supply and innovative method integration, cultural confidence education can be effectively and deeply integrated into higher vocational English teaching, thereby providing solid support for cultivating new-era talents who can shoulder the responsibility of national rejuvenation. This practice provides a useful reference for English teaching reform in similar institutions and is a powerful response to implementing “promoting cultural confidence and self-improvement” in the field of higher vocational education.

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Teaching Design and Practice of Capstone Courses for Electronic Information Majors

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Abstract: Against the background of engineering education reform, electronic information majors urgently need to construct a comprehensive, practical and innovative curriculum system to cultivate students' ability to solve complex engineering problems. As a core carrier integrating multidisciplinary knowledge and connecting theory with industrial practice, the teaching design of Capstone courses directly affects the quality of talent training. Based on the Outcome-Based Education (OBE) concept and drawing on the logic of "capstone courses" in American engineering and technology universities, this paper constructs a teaching system for Capstone courses of electronic information majors from four dimensions: curriculum goal positioning, content system construction, teaching mode innovation, and evaluation mechanism optimization. Taking the "Comprehensive Professional Experiment" as a practical carrier to verify its feasibility, this study provides a reference for similar curriculum reforms in application-oriented undergraduate universities.

Keywords: Capstone course; Engineering education accreditation; Application-oriented undergraduate universities

Online publication: December 12, 2025

1. Background

With the rapid iteration of the new generation of information technology, the demand for talents in the electronic information industry presents the characteristics of "compound, innovative, and practical." The Engineering Education Accreditation Standards (2024 Edition) clearly requires that majors should cultivate students' ability to comprehensively apply mathematics, natural sciences and professional knowledge to solve complex engineering problems. However, traditional professional courses have problems such as a disconnection between theory and practice and insufficient interdisciplinary integration, which make it difficult to meet industrial needs and accreditation standards^[1].

Originating from American engineering and technology universities, Capstone courses are core positioned to "integrate prior professional knowledge and solve practical engineering problems," realizing the transformation from "knowledge mastery" to "ability output," while taking into account the cultivation of non-technical literacy such as communication skills, ethical responsibility and cost control^[2]. Foreign Capstone courses have formed a

mature teaching model. Most American universities adopt an industry-real-problem-oriented approach and carry out teaching through interdisciplinary team cooperation and school-enterprise joint guidance. The undergraduate Capstone courses of top universities such as the Massachusetts Institute of Technology (MIT) and Olin College of Engineering are mostly characterized by interdisciplinarity, high authenticity and cutting-edge nature, and implement a project-centered multi-participation framework in the implementation process^[3-5]. Through interdisciplinary case analysis, Lee confirmed the core role of Capstone courses in cultivating students' problem-solving ability and team cooperation ability, and emphasized the need to supplement differentiated ability training goals according to professional characteristics^[6].

Drawing on the concept of Capstone courses in foreign universities, many domestic universities have been promoting the construction of Capstone courses in recent years. Taking the construction of emerging engineering in local universities as the background, Wang Jianjun proposed a "four-in-one" implementation model for comprehensive practical courses^[7]. Deng et al. verified the effectiveness of teaching reform based on the Capstone concept in improving students' system design and innovation capabilities, but the curriculum content was not closely combined with industrial reality^[8]; Rao Lan et al. found in the reform of comprehensive curriculum design that project-based teaching can effectively improve students' engineering practice ability, but the evaluation mechanism needs to be further optimized^[9].

This paper aims to address the design of Capstone courses for electronic information majors in application-oriented undergraduate universities, and explore how to align with engineering education accreditation standards and establish a scientific evaluation mechanism.

2. Design goals and principles of capstone courses

2.1. Curriculum design goals and content

The goal of Capstone courses for electronic information majors in application-oriented undergraduate universities is to cultivate engineering thinking on the basis of technical ability training, enabling students to analyze and solve problems from multiple dimensions such as technology, economy and society^[10,11]. The design content includes:

- (1) Clarify the mapping relationship between curriculum goals and graduation requirements;
- (2) Design a curriculum content system of "interdisciplinary integration + real project-driven";
- (3) Innovate a teaching implementation model of "school-enterprise collaboration + team cooperation + progress control";
- (4) Establish a quality assurance mechanism of "formative evaluation + diversified feedback"^[12].

2.2. Core principles of curriculum design

- (1) Real Project-Driven Principle: Based on enterprise engineering cases, select industrial hot issues as curriculum projects, simulate the complexity, time constraints and economic cost limitations of real engineering scenarios, and improve students' ability to solve practical problems.
- (2) Interdisciplinary Integration Principle: Integrate multidisciplinary knowledge such as electronic technology, intelligent information processing, computer programming and data analysis, and incorporate basic content of project management and economics to cultivate students' ability to comprehensively apply cross-disciplinary skills to solve complex problems^[13].
- (3) Continuous Improvement Principle: Establish a closed-loop mechanism of "content design - teaching

implementation - effect evaluation - feedback optimization,” dynamically adjust curriculum content and teaching methods according to students’ performance and tutors’ feedback during the course, and ensure the continuous improvement of curriculum quality.

3. Curriculum teaching design framework

3.1. Curriculum goal positioning: Aligning with industrial needs and professional characteristics

According to the professional curriculum system and the characteristics of Capstone courses, integrate content related to engineering awareness training, and establish the mapping relationship between curriculum goals and graduation requirement observation points ^[14], as shown in **Table 1**.

Table 1. Correspondence between graduation requirements and curriculum goals

Graduation requirement observation points	Curriculum goals
Design/Development	Be able to design electronic information systems that meet specific needs, reflecting innovation and feasibility, while considering various social constraints.
Team Collaboration	Be able to assume roles in interdisciplinary teams, communicate and cooperate effectively, and complete assigned tasks.
Project Management and Economic Decision-Making	Be able to reasonably plan project progress and team division of labor, control progress within the practice cycle; be able to conduct cost budget accounting and carry out program cost-benefit analysis.
Engineering Ethics and Professional Norms	Abide by industry ethics and legal norms, and establish a sense of responsibility and cost-saving awareness.

3.2. Curriculum content system: Modular design based on courses

Adopt an organizational method of “modularization + projectization” to construct a three-level content system of “basic module - core module - extended module.”

3.2.1. Basic module

Covers content such as engineering ethics and professional norms, basic project management (WBS task decomposition, Gantt chart drawing), economic decision-making methods (benefit analysis, budget accounting), and technical research methods.

3.2.2. Core module: Divided into four sub-modules

- (1) Project Approval and Program Design: Team formation (3–5 people/team), topic selection and demonstration (combined with industrial needs), technical route planning, feasibility analysis (including economic evaluation, such as hardware cost budget), and completion of thesis proposal;
- (2) System Development and Implementation: Hardware selection and development (balancing performance and cost), software programming and debugging, system integration and testing, synchronous recording of project progress, and control of time nodes using Gantt charts;
- (3) Outcome Optimization and Improvement: Improve the program based on test results and economic feedback to enhance system performance and stability;
- (4) Outcome Display and Defense Preparation: Write research reports, produce demonstration prototypes,

and conduct internal pre-defense.

3.2.3. Extended module

Combine cutting-edge industrial trends to set special lectures on artificial intelligence applications, green low-carbon technologies, etc., to expand students' professional horizons and thinking. Encourage students to integrate new technologies (such as edge computing) into program design.

3.3. Teaching implementation model: “Dual-Tutor System + Four-Stage Cycle + Progress Control”

- (1) Dual-Tutor Formation: On-campus professional teachers are responsible for theoretical guidance, process management and project management teaching; enterprise technical experts are responsible for engineering practice guidance, industrial demand connection and economic decision-making comments.
- (2) Four-Stage Teaching Process^[15]:
 - (A) Stage 1: Curriculum Planning and Project Approval. Students form teams based on the principle of complementary advantages, determine project themes under the guidance of dual tutors, complete literature research and program design (including economic analysis), and clarify the progress plan (in the form of Gantt charts);
 - (B) Stage 2: Project Implementation and Process Guidance. Teams divide labor and cooperate, hold daily meetings to report progress and solve problems; tutors provide precise guidance through on-site or online methods, focusing on technical difficulty breakthroughs, project progress control and cost control;
 - (C) Stage 3: Outcome Optimization and Display Preparation. Teams complete system testing and optimization, improve project reports, and produce demonstration prototypes and defense materials;
 - (D) Stage 4: Outcome Evaluation and Feedback. Conduct outcome acceptance through public defense, work display and other forms; dual tutors and peer experts jointly comment, focusing on feedback on the feasibility of technical programs, project management effectiveness and rationality of economic decisions, and form improvement suggestions.
- (3) Progress and Cost Control Measures: Establish a mechanism of “daily progress check-in + mid-term cost verification”, requiring teams to update progress daily and submit cost accounting forms in the mid-term; enterprise tutors evaluate cost control to avoid exceeding the budget.

3.4. Evaluation mechanism optimization: “Three-Dimension, Multi-Subject Evaluation”

3.4.1. Evaluation dimensions and weights

- (1) Process Performance (40%): Including project participation, team contribution, completeness of technical documents, and effectiveness of project progress and cost control, scored by on-campus tutors based on daily progress records and mid-term verification results;
- (2) Outcome Quality (40%): Covering system function realization, technical innovation, economic rationality and report standardization, jointly scored by dual tutors, with enterprise tutors focusing on evaluating economic decision-related indicators;
- (3) Defense Performance (20%): Including oral expression, logical thinking, outcome display effect and question response.

3.4.2. Multi-subject evaluation

Introduce a multi-subject evaluation system of “student self-evaluation + team mutual evaluation + enterprise tutor evaluation + on-campus tutor evaluation”. Among them, enterprise tutor evaluation focuses on the standardization of project management and the scientificity of economic decision-making; student self-evaluation and team mutual evaluation need to include reflections on their own and the team’s progress control and cost awareness to ensure the objectivity and comprehensiveness of evaluation results.

3.4.3. Continuous improvement mechanism

Link evaluation results with curriculum optimization, and incorporate curriculum evaluation data into graduation requirement achievement analysis. Collect student feedback and enterprise suggestions, dynamically adjust curriculum content and assessment methods, and form a closed-loop management of “evaluation - feedback - improvement”.

4. Practical case and effectiveness analysis of “Comprehensive Professional Experiment” in electronic information engineering major of our university

The “Comprehensive Professional Experiment” is a 3-week Capstone course in the second semester of the junior year. Taking the 2024 autumn semester project “Development of an Intelligent Warehouse Monitoring System Based on the Internet of Things” as an example, the project was completed by a team of 4 students: the team decomposed tasks using WBS tools, planned the 3-week progress through Gantt charts, and updated the progress account daily; in the program design stage, the team compared two schemes, “STM32-based” and “Loongson 1C102-based”, conducted cost-benefit analysis from three dimensions of hardware cost, development cycle and later maintenance cost, and finally selected “Loongson 1C102-based”; when “hardware procurement costs exceeded the budget” was found in the mid-term, after team discussion and tutor guidance, the scheme of “replacing low-cost sensors” was adopted, and the total cost was finally controlled within the budget; the project successfully realized the core functions of the system, and the team clearly expounded the progress control and cost optimization ideas in the defense, winning unanimous praise from the defense committee.

Through the curriculum quality evaluation of the “Comprehensive Professional Experiment” in this semester, it was found that students performed well in project management and economic decision-making abilities. 90% of students could independently use Gantt charts to complete project progress planning, 78% of students could achieve cost control in the project, and students’ engineering thinking and innovation abilities were significantly improved, which strongly supported the achievement of graduation requirements.

However, the course still has the following problems: first, some projects have a gap with engineering reality; second, the 3-week intensive practice cycle is relatively short, resulting in great pressure on progress control for some complex projects. In the next teaching cycle, improvements need to be made in optimizing teaching content and flexibly adjusting the cycle.

5. Conclusion

The Capstone course constructed in this paper takes “basic-core-extended” as the content module, adopts the implementation model of “dual-tutor system + four-stage cycle + progress control”, and strengthens school-enterprise collaboration and process management; with “three-dimension, multi-subject” as the evaluation

mechanism, it effectively supports the training goals of students' engineering practice ability, team cooperation ability, project management and economic decision-making ability. It provides replicable and promotable experience for the reform of Capstone courses for electronic information majors in application-oriented undergraduate universities.

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Research on the Teaching Reform of Curriculum Ideological and Political Education in Higher Vocational Colleges from the Perspective of Industry-Education Integration and Digital Empowerment

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Abstract: Against the background of the digitalization of higher education, digitalization has become an effective measure for the construction of curriculum ideological and political education in colleges and universities. Teaching practice has shown that industry-education integration is an important approach and means for the “three teaching reforms” in higher vocational colleges, as well as a prominent feature and important guiding principle for carrying out the reform and innovation of curriculum, ideological and political teaching in these colleges. From the perspective of in-depth industry-education integration, the curriculum ideological and political teaching in higher vocational colleges faces problems such as the localization of communication mechanisms among curriculum ideological and political education subjects, the fragmentation of local educational resource excavation, and the one-sidedness of curriculum ideological and political teaching evaluation. Therefore, based on the background of the digital era, this paper explores three major paths of digital empowerment for curriculum ideological and political education in higher vocational colleges: the school-enterprise dual-member collaboration of subjects, the co-construction and sharing of school-enterprise curriculum ideological and political teaching resources, and the scientific and intelligent two-way teaching evaluation between schools and enterprises, aiming to promote the curriculum teaching reform in higher vocational colleges from the perspective of in-depth industry-education integration.

Keywords: Industry-education integration; Digitalization; Higher vocational colleges; Curriculum ideological and political education; Teaching reform

Online publication: December 12, 2025

1. Dilemmas of the teaching reform of curriculum, ideological and political education in higher vocational colleges from the perspective of industry-education integration

1.1. The communication mechanism among curriculum, ideological and political teaching subjects is relatively localized

Although schools and industry enterprises have formed various cooperation models, such as vocational education groups, on-campus and off-campus practical teaching bases, and industry-education integration communities through long-term cooperation, their functions have not been fully activated and effectively transformed in the process of curriculum ideological and political teaching reform^[1]. Most cooperations still focus on practical aspects such as professional curriculum settings, training condition construction, and employment connection, lacking systematic design and institutional arrangements for the integration of ideological and political education elements. Schools and enterprises rarely conduct in-depth dialogues on the goal positioning, content connection, and implementation paths of curriculum ideological and political education in cooperation, resulting in the difficulty of truly embedding ideological and political education into the entire process of industry-education collaborative talent training.

As an important carrier for integrating regional educational resources, vocational education groups should have become key hubs for promoting the sharing of curriculum ideological and political resources and the common understanding of concepts. However, in actual operation, their management structure is mostly administrative-led, and enterprise participation mostly stays at the level of signing agreements or project naming, lacking regular communication channels and division of responsibilities mechanisms^[2]. Although off-campus practical teaching bases provide students with real work scenarios, enterprise tutors generally lack an understanding of the connotation of ideological and political education, focusing more on operational norms and professional discipline during guidance, while neglecting value guidance and social responsibility cultivation. The absence of an inter-subject communication mechanism makes it difficult for curriculum ideological and political education to achieve cross-domain collaboration and resonance, restricting the comprehensive achievement of the goal of cultivating high-quality technical and skilled talents.

1.2. The excavation of local educational resources for curriculum ideological and political content is relatively fragmented

The selection of curriculum ideological and political content mostly relies on the individual experience, judgment and subjective preferences of teachers, lacking unified planning and top-level design. Teaching materials are scattered in sources and unfocused in themes, making it difficult to form a coherent value guidance context. Although some teachers attempt to introduce local culture, industry models, or regional development cases in teaching design, these elements are mostly embedded in classrooms as decorative content, failing to organically connect with the professional knowledge system^[3].

Due to the lack of a long-term operation mechanism and systematic design, local educational resources have not been truly transformed into a stable teaching support force. Most higher vocational colleges have not incorporated the development of localized resources into the revision of curriculum standards, the construction of teaching teams, or the teaching quality evaluation system, resulting in this work being marginalized and difficult to obtain continuous investment and policy inclination. Teachers lack professional guidance and technical support in the process of resource collection, content transformation, and teaching application, which further exacerbates the randomness and unsustainability of the work^[4]. Higher vocational colleges have not yet established a

collaborative education environment driven by local resources as the core, leading to an insufficient connection between ideological and political education and students' growth environment, a weak education atmosphere, and affecting the effectiveness and appeal of value shaping.

1.3. The curriculum ideological and political teaching evaluation system is relatively one-sided

The existing evaluation mechanism mostly focuses on assessing teachers' "teaching" level, focusing on links such as lesson plan design, classroom teaching, and teaching organization, and emphasizing whether teachers integrate ideological and political elements into professional curriculum content. However, in the dimension of students' "learning," the evaluation is obviously weak, failing to fully reflect students' ideological changes, value recognition, and behavioral performance after receiving curriculum ideological and political education^[5]. As the core subject of the education process, students' learning experience, emotional resonance, value internalization, and daily behavior transformation have not been systematically included in the evaluation scope, and the evaluation results are difficult to truly reflect the actual effect of curriculum ideological and political education.

From the perspective of evaluation methods, the current general practice is to carry out summative evaluation in the form of final questionnaires, phased tests, or course completion reports, emphasizing result output rather than the growth process^[6]. Evaluation standards tend to be unified, rarely considering the diversity of students' acceptance of ideological and political education with different professional backgrounds, individual differences, and development stages, which inhibits the space for personalized development. The application of formative evaluation tools is limited, and a comprehensive evaluation model based on multi-source data, such as daily classroom interaction, social practice participation, and team collaboration performance, has not been established. Furthermore, the concept of value-added evaluation has not been implemented, making it difficult to measure the progress of students before and after receiving curriculum ideological and political education. The application of digital technology is still in its initial stage, lacking a precise, dynamic, and visual evaluation support system relying on big data analysis, learning behavior modeling, intelligent feedback systems, etc., which limits the scientificity and effectiveness of evaluation^[7].

2. Paths of digital empowerment for the teaching reform of curriculum, ideological and political education in higher vocational colleges from the perspective of industry-education integration

2.1. Digital empowerment for the school-enterprise dual-member collaboration of curriculum ideological and political subjects in higher vocational colleges

Digital technology is deeply embedded in the construction of curriculum, ideological and political teaching subjects in higher vocational colleges. By introducing a talent training program management platform, schools and enterprises can align goals at the initial stage of curriculum design and jointly formulate a teaching goal system that meets industrial needs and ideological and political education orientation^[8]. The platform supports online collaborative revision of training programs by both parties, ensuring the organic integration of curriculum, ideological and political elements into professional courses, and avoiding the problems of lagging school-enterprise connection or information asymmetry in traditional models. The curriculum, ideological and political teacher management and training platform provides a unified qualification review, competence evaluation, and continuous development channel for on-campus and off-campus teachers. Enterprise technical personnel can be

included in the part-time teacher team through a certification mechanism, and complete pre-service training on teaching norms, ideological security, etc., on the platform to improve their ability and sense of responsibility in carrying out curriculum ideological and political education.

The phased teaching management platform divides the entire teaching process into several phase nodes, supporting the closed-loop operation of “introduction—implementation—feedback—optimization.” Each phase sets clear ideological and political teaching tasks and observation indicators. On-campus teachers are responsible for theoretical teaching and value guidance, while enterprise teachers conduct situational teaching combined with on-the-job practical cases. Both parties record teaching behaviors, upload teaching resources, and track students’ growth trajectories on the platform^[9]. Students’ learning data, participation, value performance, and other information are transmitted back to the platform in real time to form dynamic portraits for analysis by both schools and enterprises. The data flow between multiple subjects continuously circulates among “on-campus teachers—enterprise teachers—enterprises—schools—platform—students”, breaking the fragmented state of subjects in traditional teaching and realizing the whole-process and full-chain collaborative linkage.

At the management level, the teaching behavior logs, interaction frequency, resource utilization rate, student satisfaction, and other data collected by the platform are used to dynamically monitor the quality of school-enterprise collaboration. The system can automatically identify weak links in cooperation and issue early warnings to help school administrative departments formulate precise policies. On-campus managers can grasp the overall operation situation through a visual dashboard, and enterprise managers can also timely understand the performance of employees participating in teaching. The built-in messaging system, meeting booking module, and collaborative editing function of the platform provide a stable and efficient communication environment for on-campus and off-campus teachers, supporting the regular development of cross-organizational teaching and research activities^[10].

2.2. Digital empowerment for the co-construction and sharing of school-enterprise curriculum ideological and political teaching resources

Using big data analysis and cloud computing technology, the form of teaching resources is no longer limited to traditional text handouts or PPT presentations, but expands to multimedia and interactive content^[11]. Various elements such as images, audio, 3D models, and timeline demonstrations are embedded in curriculum design, transforming abstract ideological and political concepts into perceptible and interactive learning experiences, and realizing the visualization and three-dimensional presentation of teaching content. Students understand core values such as professional ethics, craftsman spirit, and social responsibility in an immersive digital environment, enhancing emotional resonance and cognitive internalization.

The application of video and animation resources in curriculum ideological and political teaching has effectively improved the situational sense and attractiveness of teaching. Real enterprise work scenarios can be restored through high-definition documentary short films, showing the value choices of front-line employees when facing professional challenges^[12]; typical character deeds are presented in the form of micro-documentaries to strengthen the role model leading effect. Animations are used to simulate complex ethical situations, such as the responsibility tracing of safety production accidents and the integrity choices in business decisions, helping students conduct moral judgment and behavioral reflection in virtual situations. These resources are jointly planned for scripts, provided with materials, and reviewed for content by both schools and enterprises to ensure that they not only conform to the laws of education and teaching but also are close to actual industrial needs.

Artificial intelligence and virtual reality technologies have further deepened the development and sharing

mechanism of local educational resources. The AI-driven intelligent recommendation system can accurately push highly matched case resources according to students' professional backgrounds, learning trajectories, and value tendencies, improving the effect of personalized education. Chatbots based on natural language processing can provide ideological and political Q&A services after class, extending the time and space of education. VR technology is used to reconstruct local red cultural sites, intangible cultural heritage inheritance workshops, or historical and cultural exhibition halls of key enterprises. Teachers and students can carry out "cloud visits" and "cloud research" through virtual roaming, intuitively feeling the regional development context and industrial spiritual connotation^[13]. All resources are uploaded to a cloud database co-managed by schools and enterprises after standardized coding, realizing open access and continuous iteration across campuses and enterprises, and truly achieving the co-construction, sharing, and win-win of high-quality ideological and political education resources.

2.3. Digital empowerment for the scientific and intelligent two-way teaching evaluation of curriculum, ideological and political education between schools and enterprises

Relying on big data platforms and cloud computing systems, behavioral data, interaction records, assessment results, and other information in the teaching process can be collected and updated in real time. Enterprise tutors and school teachers can continuously observe and provide feedback on students' ideological and political dimensions, such as value cognition, professional quality, and social responsibility at different time nodes through a unified digital evaluation system. The online evaluation module is embedded in the daily teaching process, integrating phased evaluation, project-based assessment, and process observation to form a closed-loop management throughout the teaching cycle^[14]. Enterprise participation in evaluation is no longer limited to a single score at the end of the internship, but through a digital dashboard to real-time view students' non-cognitive ability performance such as team collaboration awareness and craftsman spirit practice in curriculum tasks, realizing the synchronous linkage between schools and enterprises in monitoring education effectiveness.

The intelligent architecture of the evaluation system supports schools and enterprises to set differentiated evaluation models according to actual needs, promoting the personalized development of curriculum, ideological, and political evaluation. Artificial intelligence algorithms can automatically match the corresponding weight of ideological and political literacy indicators according to the talent training goals of different professional groups. For example, engineering majors focus on the quantitative analysis of professional ethics and safety norms, while service majors strengthen the behavioral identification of integrity awareness and humanistic care. Learning analysis technology generates personalized ideological and political literacy growth portraits by clustering multi-modal data of students in scenarios such as virtual simulation, online discussions, and case studies^[15]. Enterprises can customize evaluation parameters on the platform according to the post-competency model, integrating the unique value requirements of the industry into the scoring system. Both school and enterprise subjects can intuitively grasp the value development trajectory of each student through visual reports, and achieve precise education through collaborative intervention.

3. Conclusion

To implement the fundamental purpose of fostering virtue through education and realize the transformation from "ideological and political courses" to "curriculum ideological and political education," the core lies in reflecting the typical characteristics of vocational education and realizing the collaborative education of ideological and

political courses and curriculum ideological and political education. Therefore, as a prominent feature of the type characteristics of education, industry-education integration is not only an important guiding principle for the reform and innovation of curriculum ideological and political teaching in higher vocational colleges, but also an essential magic weapon for promoting the reform and innovation of curriculum ideological and political teaching. In the era of digital education, how to use digital means such as computer technology and network communication technology to break the obstacles of curriculum ideological and political teaching and education caused by space and time, organically integrate higher vocational colleges and industry enterprises, the two major subjects of curriculum ideological and political teaching, and provide strong technical support for the reform and innovation of curriculum ideological and political teaching from the perspective of industry-education integration, is a new research direction that must be innovated and broken through under the background of the vigorous development of curriculum ideological and political education and the construction of a digital China.

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Research on the Teaching Transformation and Practice of College English Courses in the Context of Industry-Education Integration

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Abstract: Industry-Education Integration serves as a key task of the “Double High Plan” and plays a vital role in deepening Higher Education Reform. With the emergence of new industries, new business models, and new commercial formats, higher education must meet the evolving demands of enterprises to ensure graduates’ specialized knowledge, practical skills, and comprehensive competencies remain balanced. College English, as a basic course in higher education, currently faces a disconnect between teaching aims and industrial needs, thereby limiting the effectiveness of talent cultivation. This paper, grounded in the context of Industry-Education Integration, clarifies the necessity of College English Transformation. It analyzes current challenges in teaching and explores strategies for transformation and implementation centered on expanding teaching resources, building listening and speaking environments, enhancing teaching capabilities, and forming assessment systems. The study aims to provide insights for making progress on the transformation of College English Courses.

Keywords: Industry-education integration; College English courses; Teaching transformation; Teaching practice

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1. Introduction

Industry-Education Integration represents a talent cultivation model that integrates industry with education, enterprises with schools, and production with teaching. Scholars worldwide have conducted extensive research on this concept. Theoretically, it signifies the organic fusion of education and industry. Practically, it emphasizes the deep, sustained, and effective alignment of industrial chains with educational chains to bridge the gap between industrial demands and talent development^[1]. Against the backdrop of free trade port development, Hainan’s international cooperation has deepened across economic, tourism, cultural, and healthcare sectors. This presents opportunities for the internationalization of local industries while simultaneously raising the expectations for English proficiency among professionals. Beyond mastering

specialized knowledge and skills, practitioners must now possess strong English communication and expressive abilities. However, within the traditional teaching paradigm, College English Courses remain disconnected from industry demands. Some instructors lack sufficient awareness of emerging industry needs, trends, and practices, hindering the timely updating of teaching content and methods. Consequently, students often exhibit weak listening, speaking, and applied English abilities, failing to meet corporate development requirements^[2]. Therefore, within the context of Industry-Education Integration, it is imperative to incorporate industry-specific content, deepen the transformation of College English instruction, and help students construct a language competency system characterized by “solid foundations + flexible application.”

2. The necessity of transforming college English instruction in the context of industry-education integration

2.1. Requirements for enhancing curriculum development quality

Under the framework of Industry-Education Integration, the development of College English curricula must align with industry's demands for English proficiency in talent. Curriculum development should not be confined to traditional textbook instruction but must also emphasize cultivating students' English application skills and cross-cultural communication abilities^[3]. This necessitates instructors balancing theoretical knowledge with practical training. Building upon students' foundational grasp of vocabulary and grammar, educators should design practice scenarios closely aligned with professional contexts, creating authentic language application environments to tangibly enhance students' English proficiency and practical skills. Thus, rationally designing teaching content based on textbooks while expanding English application training scenarios to meet industry demands represents essential requirements for improving curriculum quality and achieving the transformation of College English teaching.

2.2. Practical needs for students' future career development

Under the framework of Industry-Education Integration, College English instruction must address students' future professional development needs to enhance their employment competitiveness. The ultimate goal of Industry-Education Integration is to supply talent that meets industry demands, facilitating graduates' smooth transition into the workforce and achieving mutual benefits for all stakeholders. With the rise of new industries, business models, and economic sectors, foreign trade has become a major driver of regional economic development, placing increasingly higher demands on graduates' listening and speaking abilities. However, traditional English instruction has primarily emphasized reading and writing, leaving students' listening and speaking skills underdeveloped^[4]. Therefore, transforming College English teaching by comprehensively utilizing high-quality resources and advanced technologies to cultivate students' listening and speaking abilities, thereby improving their employment competitiveness, represents a practical necessity for their future career development.

3. Challenges in college English course teaching in the context of industry-education integration

3.1. Monotonous design in college English course curriculum

Currently, universities of similar types but different majors often employ identical English textbooks.

While textbook editions may vary across institutional tiers, the core instructional content remains largely homogeneous. In classroom instruction, some instructors primarily deliver textbook content without integrating student needs or disciplinary characteristics to expand knowledge. This approach overlooks the diverse English application requirements of students across different majors^[5]. Given the relatively fixed nature of College English curricula and their weak connection to professional development, some students lose interest in learning and fail to proactively explore relevant English knowledge.

3.2. Insufficient training in listening and speaking skills

The teaching objectives of College English Courses are often inadequately designed. In real-world industry settings, listening, speaking, and translation skills are frequently essential for job performance^[6]. However, in College English Courses, some instructors prioritize reading and writing abilities as primary teaching goals. They assess student learning outcomes predominantly through written examinations, placing insufficient emphasis on listening and speaking training. The limited implementation of practical listening and speaking activities hinders the balanced development of students' overall English proficiency^[7].

3.3. Enhancing requirements for teachers teaching competency

College English instructors require improved digital literacy and application skills. The digital era provides technological opportunities for developing teaching resources and innovating pedagogical models^[8]. Yet, some educators maintain outdated teaching philosophies and demonstrate limited enthusiasm for understanding and utilizing digital technologies^[9]. In course delivery, younger faculty often employ digital tools and resources, while senior instructors rarely utilize such technologies, indicating a disparity in digital teaching capabilities.

3.4. Promoting requirements for insufficiently comprehensive assessment methods

College English course evaluations primarily rely on written examinations, with excessive weighting assigned to test scores. This approach lacks assessment of students' listening and speaking abilities, resulting in an incomplete evaluation system^[10]. Under the traditional assessment framework, students often focus on memorizing knowledge points and mastering test-taking techniques. While this may yield high scores, it fails to genuinely enhance their English conversational and practical application skills.

4. Transformation and practical strategies for college English courses teaching in the context of industry-education integration

The challenges hinder the alignment of College English curricula with frontier industry demands. This can lead students to perceive English learning as “useless,” making it difficult to instill the importance of professional English and limiting future career development. The following sections propose targeted directions for teaching transformation and explore practical strategies.

4.1. Focusing on industry application frontiers to expand course resources

College English constitutes a vital component of foundational liberal arts curricula. Under Industry-Education Integration, teaching content should reasonably incorporate expanded resources tailored to students' disciplinary backgrounds. By converting cutting-edge industry materials into pedagogical assets and integrating them into the teaching framework, students gain essential support for understanding specialized

English terminology ^[11]. Specifically, instructors should adopt a differentiated approach. By researching industry demands for English proficiency across disciplines such as business, engineering, and computer science, they can selectively curate digital teaching resources as supplementary and expansive classroom content. This enables students to acquire foundational English skills while learning to understand professional development trends through English. For instance, leveraging local foreign trade enterprises, instructors can research common English conversation scenarios and industry news in the economic and trade sectors. They can develop reading materials and scenario-based simulations to expand foundational English knowledge relevant to the major, such as world cultures, Chinese and international etiquette, and business negotiation procedures, laying the groundwork for specialized English learning.

4.2. Empowering language learning with digital intelligence technologies to create listening and speaking environments

Traditional College English instruction often lacks sufficient listening and speaking practice scenarios, hindering the development of students' oral communication and conversational skills. The advancement and application of digital and intelligent technologies present new opportunities for listening and speaking instruction ^[12]. In College English teaching, instructors should prioritize listening and speaking training in alignment with Industry-Education Integration needs. By leveraging digital tools and platforms, they can create task-based, collaborative, and blended learning environments to cultivate students' interest and proficiency in listening and speaking ^[13]. At the implementation level, instructors should leverage big data and artificial intelligence technologies to identify high-quality English resources from open channels based on textbook content, student learning profiles, and professional development needs. They should conduct listening and speaking activities through blended learning approaches combining online/offline and virtual teaching methods to stimulate student engagement. Online instruction can adopt a micro-learning approach. Teachers can distribute listening and speaking resource packs before class, including vocabulary, phrases, functional sentences, and task lists. They may also encourage advanced learners to use smartphones or tablets to collect listening materials relevant to their interests or majors. In offline listening and speaking instruction, teachers should analyze data to understand students' pre-class preparation and cognitive levels. Utilizing teaching platforms, they can deliver resources of varying difficulty on the same theme to reduce comprehension barriers. Subsequently, teachers can leverage AI and virtual simulation technologies to create immersive thematic scenarios for listening and speaking practice. This facilitates peer-to-peer, teacher-student, and human-computer interactions, enabling students to apply knowledge in realistic dialogues. In human-computer dialogues, students with weaker foundations can identify expression issues and practice repeatedly without the anxiety of peer correction. Those with stronger English can refine their grammar and vocabulary usage to enhance language application skills.

4.3. Strengthening digital technology training to enhance digital teaching capabilities

Industry-Education Integration demands that College English instructors develop teaching resources and master digital technology applications. Currently, insufficient digital literacy among some English teachers constrains the expansion of teaching resources and innovation in pedagogical models ^[14]. Therefore, universities should prioritize faculty digital transformation. Systematic training programs should be designed around MOOCs, smart platforms, virtual simulation technology, and generative AI. Through blended online/offline training and collaborative teaching research, the value, application methods, and implementation

pathways of digital technologies should be promoted. Organizing digital skills teaching competitions and incentivizing faculty to enhance digital teaching application capabilities by selecting exemplary Courses can be effective. Concurrently, faculty should shift from traditional teaching paradigms by actively participating in digital-themed collective lesson planning and case studies to share practical insights. Leveraging digital platforms, they should develop more practical, engaging, and innovative digital teaching resources, continuously updating College English teaching repositories to enhance the subject's appeal. Furthermore, digital tools can be utilized to design extracurricular activities such as online English corners, digital dubbing competitions, and cloud-based translation training to ignite student enthusiasm. By connecting with corporate resources through digital platforms, students can secure practical opportunities in translation and cross-border communication, honing their language skills through real-world tasks. This “training-empowerment + practical implementation” approach elevates faculty standards and strengthens the foundation for Industry-Education Integration.

4.4. Reforming assessment methods to enhance comprehensive English proficiency

Traditional single-examination assessments deviate from the practice-oriented philosophy of Industry-Education Integration. College English Courses must comprehensively reform their evaluation systems around the principles of “comprehensiveness, practicality, and process-based assessment.” First, assessment content should be expanded by incorporating classroom dialogue performance and workplace communication skills into listening and speaking evaluations. Second, assessment formats should be diversified beyond single exams by introducing practical assessments such as English workplace presentations and cross-cultural communication exercises. Third, formative assessment should be strengthened by incorporating classroom participation and digital learning progress while reducing the weight of final written exams. Involving corporate evaluators can ensure more comprehensive and objective assessment outcomes. By establishing a diversified assessment system, students are encouraged to prioritize practical English application skills, thereby continuously enhancing their overall English proficiency^[15].

5. Conclusion

In summary, amid the transformation and internationalization trends across various industries, Industry-Education Integration serves as a crucial guiding role in advancing Higher Education Reform and Development. Meanwhile, College English Courses holds a pivotal position within the public course system, functioning as a key discipline for cultivating students' foreign language proficiency. It must align with the trends of Higher Education Reform while closely addressing the demands of Industry-Education Integration on talent cultivation and course teaching. Specifically, we should develop strategies such as developing industry-specific resources, strengthening listening and speaking training, enhancing digital teaching capabilities, and changing assessment methods to enhance students listening, speaking, reading, writing, and translation skills, simultaneously, to meet the job requirements. Ultimately, the excellent graduates support for the development of new industries, new business models, and new commercial formats.

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Research on Smart Classrooms of Information Technology in High Schools in Northern Guangdong Under the Guidance of the UbD Concept

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Abstract: With the development of informatization education, smart classrooms have gradually become the trend of high school information technology teaching. The core of the Understanding by Design (UbD) concept lies in “understanding” and emphasizes backward design, which can provide a new direction for the development of smart classrooms in high school information technology and effectively improve teaching effectiveness. From the perspective of smart classrooms of information technology in high schools in northern Guangdong, this paper analyzes the significance of integrating the UbD concept and proposes specific practical strategies, aiming to effectively improve curriculum quality, help students understand information technology knowledge, cultivate their application abilities, and provide a reference for subsequent information technology smart classrooms.

Keywords: UbD concept; Northern Guangdong; High school information technology; Smart classroom

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1. Introduction

Against the backdrop of the digital age, information technology is widely applied in various fields, imposing stricter requirements on the information literacy of talents. High school information technology courses shoulder the mission of cultivating students' information literacy, and improving their curriculum quality plays an important role. Smart classrooms can accelerate the intelligent and personalized development of teaching with the help of information technology, injecting vitality into high school information technology teaching. The UbD concept was proposed by Grant Wiggins and Jay McTighe. Taking “understanding” as the goal, this concept divides expected learning outcomes through backward design, then determines appropriate assessment criteria, and designs learning activities. The integration of the UbD concept and smart classrooms of high school information technology can effectively improve teaching activities, help students understand and apply

information technology knowledge, and cultivate high-quality talents meeting the needs of the times.

2. Significance of integrating the UbD concept into smart classrooms of high school information technology

2.1. Enhance students' in-depth understanding of information technology knowledge

The UbD concept takes “understanding” as the core. Its integration with information technology teaching emphasizes that students grasp the connotation and value of information technology knowledge. In a smart classroom environment, teachers can use rich digital resources such as animations and videos to encourage students to actively explore the essence of information technology knowledge^[1]. For example, when teaching content related to computer network principles, animation demonstrations can be used to show the transmission of data in the network, thereby truly helping students understand concepts such as network protocols and IP addresses, and enabling them to gain a deeper understanding of the knowledge.

2.2. Cultivate students' information technology application abilities and innovative thinking

The UbD concept values the improvement of students' knowledge transfer and application skills, helping them apply the learned information technology to solve practical problems. Smart classrooms can also provide students with a broad space where they can effectively carry out practical operations through online programming platforms, data analysis tools, etc.^[2] Under the guidance of the UbD concept, teachers can design challenging tasks to encourage students to apply their learned knowledge to solve corresponding problems, effectively cultivating their innovative thinking. For example, when teaching content related to database management, teachers can design campus information management system projects, encouraging students to work in groups on system design, maintenance and other activities. In project practice, students can give play to their innovative thinking and improve system functions.

2.3. Promote precision and personalization in information technology teaching

Smart classrooms can collect students' real-time data, such as learning progress and learning behaviors, with the help of big data and artificial intelligence technologies. The UbD concept emphasizes student-centeredness and pays attention to students' knowledge learning needs and differences, enabling flexible analysis of students' learning data so that teachers can understand each student's situation and promote the realization of precise teaching^[3]. For students with learning difficulties, teachers can provide personalized tutoring. For top-performing students, teachers can set extended tasks to meet their differentiated needs and promote the common progress of all students.

2.4. Promote the reform of high school information technology teaching in Northern Guangdong

In northern Guangdong, there is an imbalance in the informatization development of education, and the teaching methods and concepts of some schools are relatively traditional. The integration of the UbD concept and smart classrooms of high school information technology can provide new ideas for the innovation of information technology teaching^[4].

3. Practical strategies for smart classrooms of information technology in high schools in Northern Guangdong under the guidance of the UbD concept

3.1. Backward design based on the UbD concept

Firstly, attach importance to setting expected learning outcomes. Teachers need to clarify the goals that students should achieve in high school information technology courses, which involve not only the mastery of knowledge and skills but also emphasize students' understanding of information technology concepts and actively cultivate their application skills ^[5]. For example, when teaching the basic unit of artificial intelligence, the expected outcomes can be set as students understanding the concept and application fields of artificial intelligence and using simple artificial intelligence algorithms to solve practical problems. Teachers can also combine the actual situation of northern Guangdong and relevant curriculum standards to ensure the clarity and achievability of expected outcomes.

Secondly, set assessment criteria according to expected outcomes. Teachers can design accurate assessment forms to evaluate students' achievements, and the specific assessment evidence should include students' homework, test scores, and classroom performance ^[6]. Regarding students' knowledge learning outcomes, teachers should not only pay attention to their mastery of knowledge but also cultivate their ability to understand and apply knowledge. For example, when assessing students' learning outcomes of basic artificial intelligence, teachers can not only use tests to judge students' understanding of basic concepts, but also encourage students to complete artificial intelligence projects, such as designing image classifiers and use the project completion status to evaluate their knowledge application skills.

3.2. Utilize smart classroom technology to support teaching implementation

Firstly, actively create teaching scenarios. Smart classrooms of high school information technology can use multimedia, virtual reality and other technologies to create vivid teaching scenarios and enhance students' interest in knowledge learning. From the perspective of information technology teaching, teachers can use relevant technologies to design scenarios related to teaching content ^[7]. For example, when teaching content related to information security, teachers can use virtual technology to simulate hacker attack scenarios, allowing students to have an immersive experience, understand the significance of information security protection, and guide them to think about how to ensure information security, thereby enhancing their enthusiasm for knowledge exploration. The creation of teaching scenarios can help students understand information technology knowledge and encourage them to actively engage in learning.

Secondly, promote the realization of personalized learning. Smart classrooms can provide personalized support based on students' data and characteristics. Teachers can use smart classroom analysis systems to understand students' knowledge, learning progress and mastery, and provide them with high-quality personalized learning resources. For example, for students with slow learning progress, the system mainly recommends basic knowledge explanation content. For students with spare capacity, the system mainly recommends extended content to meet their interest in knowledge exploration ^[8]. At the same time, smart classrooms allow students to freely choose learning content. Students can flexibly arrange their learning time according to their own interests, improving the flexibility of the curriculum.

Thirdly, promote teacher-student and student-student interaction. Smart classrooms provide a variety of interaction methods such as online discussions, real-time Q&A, and group collaboration, which can promote interactive communication between teachers and students and among students. In high school information technology teaching, teachers can use the interactive functions of smart classrooms to organize students to

conduct discussions and cooperative learning^[9]. For example, when learning “database design,” teachers can divide students into groups and let them complete a database design project together through an online collaboration platform. Group members can conduct real-time communication, division of labor, and cooperation on the platform to jointly solve problems encountered in the project. Teachers can real-time understand the group’s discussion progress and project development through the platform and provide timely guidance and feedback. Through teacher-student and student-student interaction, students’ teamwork spirit and communication skills can be cultivated, and learning effectiveness can be improved.

3.3. Improve the teaching evaluation system

Firstly, attach importance to the diversification of evaluation subjects, including teacher evaluation, student self-evaluation and mutual evaluation. Among them, teacher evaluation should follow the principles of comprehensiveness and objectivity to judge students’ knowledge learning process and outcomes, and pay attention to their learning attitudes and methods^[10]. Student self-evaluation enables students to reflect on and evaluate their own learning process and outcomes, clarify their strengths and weaknesses, and set clear directions for improvement. Student mutual evaluation can strengthen communication and cooperation among students, allowing them to obtain suggestions from peers, thereby conducting targeted learning and improving learning effectiveness.

Secondly, focus on the application of diverse evaluation methods. Teachers can combine formative and summative evaluations. Formative evaluation mainly uses data such as classroom performance and homework to understand students’ learning situation, providing a basis for curriculum optimization^[11]. Summative evaluation mainly objectively assesses students’ knowledge and learning outcomes through examinations, project presentations, etc. At the same time, performance evaluation and other methods can be used to comprehensively and objectively judge students’ information technology literacy.

Thirdly, teachers need to provide timely feedback on evaluation results to students to help them understand their own learning situation and identify existing problems. Based on the evaluation results, teachers can provide students with personalized opinions and guidance, helping them adjust their learning methods and effectively improve their learning outcomes^[12]. At the same time, evaluation results can provide a basis for teachers to adjust and improve teaching. Teachers can adjust teaching designs and strategies according to the evaluation results to effectively improve teaching quality. For example, if a student has an insufficient understanding of certain knowledge, teachers can focus on explaining and guiding that knowledge to cultivate students’ literacy in a targeted manner.

3.4. Strengthen teacher training and professional development

Firstly, schools can carry out training on the UbD concept and smart classroom technology. In order to better infiltrate the UbD concept into smart classrooms of high school information technology, it is necessary to attach importance to teacher training and improve teachers’ quality. The training content specifically includes the basic principles of the UbD concept and backward teaching design skills. Through training activities, teachers can understand the value of the UbD concept and become familiar with the application of various technologies and tools in smart classrooms^[13]. Specific training methods can combine online and offline approaches, encouraging experts and scholars to give lectures, and guiding teachers to participate in practical operations and case analysis to effectively improve their professional quality.

Secondly, establish a teacher professional learning community to promote communication and cooperation

among teachers. Teachers can share teaching experience, teaching resources and teaching achievements in the community, and jointly discuss problems encountered in teaching and their solutions^[14]. Thirdly, actively advocate teachers to conduct in-depth teaching reflection and continuous improvement. Teachers should persistently reflect on their teaching practice, systematically sort out and summarize valuable experiences and profound lessons accumulated in the teaching process, keenly identify various explicit or implicit problems in teaching, and quickly take effective measures for targeted improvement and optimization. In the specific implementation of teaching activities, teachers can use various methods such as keeping detailed teaching logs and extensively collecting and carefully analyzing students' feedback to comprehensively and accurately understand the actual effect of their teaching and the specific situation of students' learning^[15].

3.5. Practical case of UbD strategy: Teaching of “Data Visualization and Local Agricultural Data Analysis in Northern Guangdong”

Combining the regional characteristics of abundant agricultural resources in northern Guangdong (such as characteristic agricultural products like Heyuan citrus and Shaoguan tea), taking the “Data and Data Processing” unit of high school information technology as an example, the smart classroom teaching practice under the UbD concept is carried out. Firstly, determine expected learning outcomes. Combining the “General High School Information Technology Curriculum Standards” and the needs of agricultural development in northern Guangdong, set core literacy expected goals: information awareness, computational thinking, digital learning and innovation, and information social responsibility. Secondly, design assessment evidence. Adopt a dual-track assessment of “formative + summative” to ensure coverage of knowledge, understanding and application abilities.

- (1) Activity 1: Scenario Introduction (5 minutes). Use the “VR Resource Library” of the smart classroom to play VR videos, present real cases, and trigger students' thinking.
- (2) Activity 2: Knowledge Exploration (10 minutes). Through the “micro-lectures + online quizzes” module of the smart classroom, push micro-lectures on data visualization principles, and students complete immediate quizzes after independent learning.
- (3) Activity 3: Practical Operation (15 minutes). Adopt “heterogeneous grouping” and use the “group collaboration platform” of the smart classroom to complete tasks.
- (4) Activity 4: Outcome Optimization and Presentation (10 minutes). Based on the peer evaluation function of works in the smart classroom, after groups upload visualization works, students conduct mutual evaluation according to the assessment scale provided by teachers.

4. Conclusion

In summary, the integration of the UbD concept and smart classrooms of high school information technology can promote teaching innovation, help students understand information technology knowledge, cultivate their information technology application skills, and improve the level of precise teaching. From the perspective of curriculum teaching practice, teachers can use the UbD concept for backward teaching design, rely on smart classroom technology to promote the smooth development of teaching, build a sound teaching evaluation system, and escort students' growth. Through the implementation of practical strategies, the advantages of the UbD concept and smart classrooms can be brought into play, effectively improving the quality of information technology teaching and cultivating talents meeting the needs of the times.

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Integrating Ideological and Political Education into Pathogenic Biology and Immunology: An Exploration of Curriculum Reform

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Abstract: This study explores the effective integration and implementation of curricular ideological-political education (IPE) within the Pathogenic Biology and Immunology course for higher vocational medical and pharmaceutical programs. Objective: To synergize ideological-political education with discipline-specific knowledge in order to enhance students' professional competence and humanistic values. Methods: Key IPE elements, including patriotism, scientific spirit, humanistic care, and public health awareness, were embedded into the curriculum. Through case-based instruction, pedagogical innovation, and a post-intervention questionnaire survey, the study examined effective approaches for integrating IPE into subject teaching. Results: The research successfully achieved an organic fusion of disciplinary content and ideological-political elements, leading to the development of a novel instructional framework. Feedback from the questionnaire informed iterative refinements to the strategy, which not only deepened students' understanding of core scientific concepts but also strengthened their sense of social responsibility and ethical awareness. Conclusion: This study offers a replicable and effective teaching model that can serve as a valuable reference for curriculum design and pedagogical reform in Pathogenic Biology and Immunology courses within higher vocational medical and pharmaceutical education, ultimately contributing to the holistic development of students' professional ethics and comprehensive competencies.

Keywords: Ideological and political education in courses; Pathogenic biology and immunology; Teaching strategies; Educational research

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1. Introduction

With the profound transformation of the medical paradigm and the continuous advancement of pharmaceutical and medical education, the training objectives for higher vocational medical and pharmaceutical students have significantly evolved. Contemporary education no longer focuses solely on the acquisition of professional knowledge and technical skills but has expanded toward broader domains, particularly the cultivation of comprehensive competencies and professional ethics^[1,2]. This shift not only responds proactively to

emerging trends in the healthcare sector but also aligns precisely with the evolving demands for medical and pharmaceutical talent in the new era.

Pathogenic Biology and Immunology, as a core foundational course in higher vocational medical and pharmaceutical programs, encompasses a complex and extensive knowledge system. It serves not merely as a vehicle for disciplinary instruction but also as a critical bridge linking classroom learning to future professional practice. In this course, we systematically integrate the concept of “curricular ideological and political education” (hereafter referred to as “course-based ideological-political education” or “course IPE”), aiming to organically embed value-oriented education within professional knowledge delivery. The implementation of course IPE not only enhances students’ learning motivation and engagement but also subtly fosters their professional integrity and sense of social responsibility ^[3]. Through this integrative approach, students not only master core concepts in pathogenic biology and immunology but also deepen their understanding of the medical profession and clarify their career orientation and developmental trajectory.

Therefore, incorporating course IPE into the teaching of Pathogenic Biology and Immunology represents both an innovative pedagogical exploration and an effective educational practice. Through this integrated model, faculty members can cultivate more well-rounded healthcare professionals, individuals who possess not only solid technical competencies but also strong ethical principles and a profound commitment to societal well-being, thereby contributing sustained momentum to the advancement of China’s healthcare system.

2. Instructional design strategies for course-based ideological-political elements

The essence of course IPE lies in the seamless integration of knowledge transmission and value cultivation ^[4]. In teaching Pathogenic Biology and Immunology, instructors must move beyond mere content delivery to emphasize the dual goals of “knowledge acquisition” and “value shaping.” This involves guiding students to reflect on societal issues, contemplate the meaning of their professional roles, and strengthen their sense of mission and responsibility. Accordingly, key ideological-political elements embedded in this course include: patriotism, scientific and exploratory spirit, humanistic care and professional ethics, public health awareness and social responsibility, laboratory safety consciousness, and teamwork and communication skills ^[5–7]. By systematically incorporating these dimensions, the course facilitates a deep, organic fusion of disciplinary knowledge and ideological education, thereby advancing the “triple integration” of knowledge acquisition, competency development, and value formation ^[8–10]. Specific instructional strategies are outlined below.

2.1. Scientific and exploratory spirit

As a rigorous scientific discipline, Pathogenic Biology and Immunology embodies the principles of precision, logic, and empirical inquiry ^[11]. Instruction emphasizes the importance of curiosity, critical thinking, and intellectual courage ^[12]. Through guided activities in experimental design, data analysis, and scientific reasoning, students develop a meticulous, evidence-based approach to research. This cultivation of scientific temperament not only reinforces disciplinary understanding but also equips students with the intellectual foundation necessary for future academic and professional success.

2.2. Humanistic care and professional ethics

Medicine is as much a humanistic endeavor as it is a scientific one ^[13]. Through clinical case analyses, students are encouraged to recognize that effective medical practice requires not only technical proficiency but also empathy, respect for patient autonomy, and strict adherence to confidentiality. Emphasis is placed on core ethical

principles such as reverence for life, patient-centered care, honesty, and the commitment to heal. By integrating these values into subject-specific content, the course nurtures students' humanistic sensibilities and helps establish a strong moral compass for their future careers ^[14].

2.3. Public health awareness and social responsibility

The course maintains strong relevance to public health. Instructors reference historical and recent outbreaks—such as influenza pandemics and cholera disease, to underscore the critical importance of public health preparedness. Discussions further explore the rationale and implementation of key interventions, including infectious disease surveillance, hospital infection control, and vaccination programs ^[15]. These measures are not only directly related to the health and safety of every individual but also serve as a crucial foundation for maintaining social stability and development. Through such educational guidance, students are encouraged to grow into key figures in the field of public health with a strong sense of responsibility and mission, contributing their wisdom and strength to the construction of a healthier and safer social environment ^[16].

3. Innovative teaching methodologies

3.1. Integration of theory and practice

Instruction extends beyond theoretical exposition to emphasize experiential learning. Real-world case studies contextualize abstract concepts, enhancing relevance and engagement ^[17]. Laboratory sessions allow students to validate theoretical knowledge through hands-on experimentation. Additionally, students are encouraged to apply course content to everyday life, such as adopting hygienic practices and participating in health promotion, thereby reinforcing practical competence and appreciating the real-world value of their learning.

3.2. Diversified instructional approaches

A multimodal teaching strategy is employed, including scenario-based learning, small-group discussions, and role-playing exercises. Scenario simulations recreate authentic clinical or public health settings, improving conceptual understanding and retention. Group discussions foster peer collaboration and deepen content comprehension. Role-playing enables students to embody professional roles, enhancing empathy and situational awareness ^[18]. These methods are further augmented by digital tools, such as animated visualizations and interactive online platforms, to render complex concepts more accessible and engaging, thereby elevating overall teaching efficacy.

3.3. Enhanced faculty-student interaction

Active dialogue between instructors and students is prioritized. In-class discussions provide real-time feedback on student understanding, enabling timely instructional adjustments ^[19]. Post-class conversations allow faculty to address individual learning challenges and psychosocial concerns, offering tailored guidance and support ^[20]. Students are encouraged to voice opinions, challenge assumptions, and engage in reflective practice, activities that cultivate critical thinking, self-efficacy, and problem-solving capabilities essential for lifelong professional growth.

4. Evaluation of teaching outcomes

4.1. Expected outcomes of ideological-political integration

This study aimed to develop a tailored course IPE framework for Pathogenic Biology and Immunology in

higher vocational medical education. Through project-based learning, case-integrated instruction, and faculty mentorship, we sought to unify professional training with moral education, ultimately realizing a “triple integration” model that synergizes humanistic education, ideological guidance, and disciplinary competence to produce practice-ready pharmaceutical and medical professionals.

4.2. Questionnaire survey results

At the end of the second semester of the 2023–2024 academic year, an anonymous survey was administered to 67 students enrolled in Pharmaceutical Science Classes 231 and 232 at Guangdong Polytechnic of Industry and Commerce. The survey comprised eight items designed to preliminarily assess whether the integration of ideological-political elements achieved its intended pedagogical objectives (**Table 1**).

Results indicated high overall acceptance: six of the eight items received affirmative responses from $\geq 95\%$ of participants. The items were grouped into three interrelated dimensions that collectively enhance the internal consistency and reliability of the findings:

- (1) Value recognition (Items 1, 3, 8): Students affirmed the necessity and practical relevance of integrating IPE into the curriculum.
- (2) Learning enhancement (Items 2, 6): IPE elements increased learning interest and served as effective mnemonic anchors.
- (3) Ideational influence (Items 4, 5, 7): IPE stimulated deeper reflection on course significance and future career planning.
- (4) Item 5 (“Did the ideological-political content prompt new reflections on your future career planning?”) received a 100% affirmative response, highlighting the course’s significant impact on students’ career identity development—a topic of high personal relevance.
- (5) Item 7 (“Has course-based IPE changed your perception of this subject?”) showed a slightly lower approval rate (92.5%), suggesting that pre-existing cognitive frameworks may resist rapid transformation. This underscores the need to avoid didactic approaches and instead anchor IPE in topics that resonate with students’ lived experiences and interests.

Overall, students readily accepted the “professional knowledge + ideological education” model, viewing it as an integral component of the course. Faculty hope this approach will foster deeper professional identification and cultivate intrinsic motivation for learning.

Table 1. Survey results on the effectiveness of ideological-political integration in pathogenic biology and immunology

No.	Question	Yes (n)	No (n)	Approval (%)
1	Is it necessary to incorporate ideological-political elements into this course?	66	1	98.5
2	Do ideological-political elements increase your interest in learning?	65	2	97.0
3	Does the integration make the course more relevant to real-world applications?	64	3	95.5
4	Do these elements prompt you to reflect further on the course content?	65	2	97.0
5	Do they inspire new insights into your future career planning?	67	0	100.0
6	Do they serve as memorable anchors that enhance teaching effectiveness?	63	4	94.0
7	Has this IPE component changed your perception of the course?	62	5	92.5
8	Does IPE deepen your appreciation and understanding of this course?	64	3	95.5

6. Conclusion

This study demonstrates that integrating ideological and political education into the Pathogenic Biology and Immunology course for higher vocational nursing students significantly enhances learning engagement while cultivating professional ethics and social responsibility. By thoughtfully weaving IPE into scientific instruction, students not only grasp disease mechanisms but also internalize the mission and moral obligations of healthcare professionals. This blended pedagogical model enables students to clearly recognize their future societal roles and ethical duties as caregivers.

Looking ahead, IPE will play an increasingly vital role in higher vocational nursing education. Future efforts should deepen the integration of ideological and disciplinary content, continuously explore innovative convergence points, and refine teaching strategies. Through such sustained innovation, educators can lay a stronger foundation for students' holistic development and professional growth—ultimately nurturing a new generation of healthcare professionals who combine technical excellence with unwavering ethical commitment.

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Exploration on the Teaching Reform of “Preschool Children’s Behavior Observation” Course in Higher Vocational Colleges Under the Background of School-Enterprise Collaborative Education

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Abstract: “Preschool Children’s Behavior Observation” is a core course for preschool education majors in higher vocational colleges, and its teaching quality directly affects the formation of students’ professional core competencies. Under the current background of educational reform emphasizing school-enterprise collaborative education, the traditional teaching model has many shortcomings. Based on the analysis of the current teaching situation of “Preschool Children’s Behavior Observation” and combined with the practical teaching experience of school-enterprise cooperation, this paper explores the strategies for the teaching reform of the course from four dimensions: curriculum content, teaching model, curriculum evaluation, and teaching staff, aiming to provide constructive references for the cultivation of preschool education professionals.

Keywords: School-enterprise collaborative education; Preschool education major; Preschool children’s behavior observation; Teaching reform

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1. Introduction

Observing preschool children’s behavior is a basic ability for preschool educators to understand young children and carry out scientific education and care work. The Professional Standards for Kindergarten Teachers (Trial) points out: “Teachers observe young children in educational activities, adjust activities according to their performance and needs, and provide appropriate guidance.” and “Effectively use various methods such as observation and work analysis to understand and evaluate young children objectively and comprehensively.” The Guidelines for Evaluating the Quality of Kindergarten Education and Care include kindergarten teachers’ ability to observe and guide young children in evaluating the indicators for kindergarten education and care quality^[1]. Thus, it can be seen that the preschool education field is attaching increasing importance to kindergarten teachers’

observational ability. “Preschool Children’s Behavior Observation” is a core course for preschool education majors in higher vocational colleges, serving as an important way for students to master the ability to observe and guide preschool children’s behavior^[2]. With the in-depth implementation of the Opinions on Promoting the High-Quality Development of Modern Vocational Education, school-enterprise collaborative education has become the core direction of higher vocational education reform. However, under the traditional teaching model, the teaching of this course has many deficiencies, making it difficult to effectively cultivate students’ practical operation ability and comprehensive observation and analysis ability. Under the background of school-enterprise collaborative education, how to break the barriers between colleges and kindergartens through curriculum teaching reform and realize the in-depth integration of theoretical knowledge, practical training, and post skills has become an urgent problem to be solved. Based on the analysis of the current teaching situation of “Preschool Children’s Behavior Observation” and combined with the practical teaching experience of school-enterprise cooperation, this paper explores the strategies for the teaching reform of the course under the background of school-enterprise collaborative education, aiming to provide constructive references for the cultivation of preschool education professionals.

2. Analysis of the current teaching situation of “Preschool Children’s Behavior Observation” in higher vocational colleges

Under the traditional curriculum teaching model, the teaching of “Preschool Children’s Behavior Observation” mainly presents the following characteristics.

2.1. Curriculum content misaligned with actual post needs, lack of practicality

The existing curriculum content is mostly textbook-centered, focusing on the systematic elaboration of observation theories and methods (such as anecdotal records, running records, time sampling, etc.)^[3]. On the one hand, most textbook cases are general theoretical cases, lacking real high-quality cases from kindergartens, such as “conflict behaviors in young children’s free play” and “concentration performance in regional activities” during kindergarten daily life, leading students’ understanding of theoretical knowledge to remain at an abstract level. On the other hand, the curriculum content insufficiently covers practical content such as analyzing and interpreting observation content and data, and adjusting educational guidance strategies based on observation results, which is disconnected from the work logic of kindergarten teachers’ “observation-analysis-guidance.”

2.2. Weak practical teaching links, lack of real scenarios and experience

Practical teaching is the core link of the “Preschool Children’s Behavior Observation” course, but currently, the practical links of this course in most higher vocational colleges have several prominent problems^[4]. First, the form of practice is single, mainly focusing on observing video materials in class. Students conduct observation exercises in static scenarios, making it difficult to perceive the complexity and dynamics of young children’s behaviors in real kindergarten environments, such as failing to experience the interactivity of young children’s behaviors in group activities and the suddenness of young children’s behaviors in outdoor games. Second, the practice duration and depth of real experience are insufficient. Off-campus practice is mostly short-term internships, where students can only conduct “onlooker-style” observations, lacking opportunities for participatory observation, and cannot deeply understand the practical application of observation results in education and care work.

2.3. Insufficient school-enterprise collaborative teaching capability

Under the background of school-enterprise collaborative education, an effective collaborative teaching mechanism has not been established. On the one hand, cooperative kindergartens mostly play the role of “providing venues” and fail to deeply cooperate with colleges to design practical teaching plans, guide and evaluate the practical process. On the other hand, although backbone teachers and teaching and research leaders in cooperative kindergartens have rich practical experience, they lack systematic teaching methods and theoretical reserves, making it difficult to transform practical experience into curriculum teaching content and unable to give full play to the guiding role of industry mentors in practical teaching.

2.4. Single teaching evaluation, unable to reflect students’ actual abilities

The existing curriculum evaluation system is mainly a “summative evaluation,” with single evaluation content and single evaluation subject, which cannot fully reflect students’ professional abilities^[5]. First, the evaluation content focuses on the mastery of theoretical knowledge, mainly through written examinations, and insufficiently evaluates core professional abilities, such as students’ practical observation skills, and the professionalism of observation records, analysis, and guidance capabilities. Second, the evaluation subject is mainly college teachers, lacking the participation of industry experts from cooperative kindergartens, and the evaluation standards are not aligned with actual post needs.

3. Exploration on the teaching reform of “Preschool Children’s Behavior Observation” Under the background of school-enterprise collaborative education

Based on the analysis of the current teaching situation of “Preschool Children’s Behavior Observation”, the following strategies for the teaching reform of the course are proposed under the background of school-enterprise collaborative education.

3.1. Guided by “Course-Post-Competition-Certificate,” collaboratively build modular curriculum content with schools and enterprises

Guided by “Course-Post-Competition-Certificate” and based on school-enterprise collaboration, reconstruct the curriculum content together with cooperative kindergartens, and build three modules of “basic theory + post skills + practical innovation” to achieve precise alignment between curriculum content and post needs.

- (1) Basic Theory Module: Optimize the knowledge structure in combination with kindergarten post needs. College teachers and kindergarten teaching and research experts jointly select key teaching points, delete pure theoretical content with low relevance to posts, and add content related to professional literacy, such as “kindergarten observation work norms” and “observation ethics.”
- (2) Post Skills Module: Focus on the post ability requirements of kindergarten teachers, develop sub-modules such as “observation of young children’s game behaviors” and “observation of young children with special needs”, and combine observation methods with real post scenarios. For example, in the “observation of young children’s game behaviors” module, integrate outdoor game cases from cooperative kindergartens, carry out the same games as kindergartens in class, allow students to experience in real game scenarios, and gradually guide students to use corresponding methods to observe young children’s game participation and social behaviors in games^[6]. At the same time, integrate the relevant requirements of “behavior observation and evaluation” in provincial preschool education skills

competitions and the 1+X “Early Childhood Care” certificate into the curriculum content to strengthen observation norms and skill training.

- (3) Practical Innovation Module: Collaboratively design project-based teaching content of “observation plan design - real scenario observation - data analysis and interpretation - educational strategy formulation” with schools and enterprises. Take the actual education and care problems of cooperative kindergartens as project carriers, such as “observation and intervention of separation anxiety behaviors of young children in small classes”, and guide students to complete project tasks in groups to improve their practical innovation ability.

3.2. Innovate the “Dual-Teacher Collaboration” teaching model to improve teaching targetedness

Construct a “dual-teacher collaboration” teaching model where college teachers and kindergarten industry mentors divide labor and cooperate, give play to the advantages of both parties, and realize the in-depth integration of theoretical teaching and practical teaching.

- (1) Collaborative Teaching Process: Adopt an alternating teaching method of “classroom teaching + kindergarten practice”. After completing the theoretical teaching of one module, organize students to conduct practical observations in corresponding scenarios in cooperative kindergartens in combination with practical training. Industry mentors provide on-site guidance, and college teachers follow up synchronously to promptly solve students’ theoretical confusion in practice. For example, after teaching the “anecdotal record method”, organize students to observe young children’s free activities in kindergartens. Industry mentors demonstrate key recording points, and college teachers guide students to analyze recorded content in combination with developmental psychology theories.
- (2) Collaborative Teaching and Research Activities: Establish a “kindergarten-college joint teaching and research studio,” and regularly carry out teaching and research activities. College teachers and industry mentors jointly analyze teaching difficulties, optimize teaching plans, and transform the latest teaching and research achievements of kindergartens into curriculum teaching resources.

3.3. Optimize the “Multi-Dimensional and Three-Dimensional” evaluation system to align with post ability standards

Construct a “multi-dimensional and three-dimensional” evaluation system centered on professional abilities and jointly participated by schools and enterprises, realizing the diversification of evaluation content and evaluation subjects^[7].

- (1) Diversification of Evaluation Content: Design evaluation indicators from four dimensions: “knowledge mastery, skill operation, practical achievements, and professional literacy”. Among them, knowledge mastery accounts for 30% (mainly through theoretical tests), skill operation accounts for 30% (mainly through practical observation assessments), practical achievements account for 30% (mainly through observation reports and internship performance), and professional literacy accounts for 10% (mainly through practical attitude and teamwork performance)^[8,9].
- (2) Diversification of Evaluation Subjects: Establish an evaluation subject system of “college teachers + industry mentors + student self-evaluation”. College teachers focus on evaluating theoretical knowledge and overall practical performance, industry mentors focus on evaluating students’ observation skills and practical operation abilities in real posts, and student self-evaluation focuses on ability improvement and

teamwork performance in the learning process, ensuring the objectivity of evaluation results.

3.4. Strengthen the construction of “Dual-Qualified” teaching staff to consolidate the foundation of collaborative education

Promote the construction of teaching staff through school-enterprise collaboration to improve teachers’ theoretical teaching ability and practical guidance ability^[10,11]. On the one hand, provide opportunities for college teachers to participate in education and care work and teaching and research activities in cooperative kindergartens, collect real cases and post-demand information, and transform practical experience into teaching resources^[12,13]. On the other hand, provide teaching method training for industry mentors in cooperative kindergartens. College teachers give special lectures on “teaching design” and “case teaching method” to guide industry mentors to transform practical experience into systematic teaching content. At the same time, invite industry mentors to participate in curriculum textbook compilation and teaching plan design to improve their curriculum development ability and teaching level^[14,15].

4. Conclusion

The teaching reform of “Preschool Children’s Behavior Observation” under the background of school-enterprise collaborative education is an effective way to improve the quality of talent training for preschool education majors in higher vocational colleges^[10]. In the reform process, it is necessary to further deepen school-enterprise cooperation, establish a long-term and stable collaborative education mechanism, ensure the implementation of reform measures, and cultivate more high-quality skilled talents for the preschool education industry.

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Exploration of An Intelligent Teaching System for the Post-Lithium Battery Course Empowered by AI

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Abstract: This study addresses critical challenges in Post-Lithium Battery Courses, including outdated knowledge, disconnection between theory and practice, and simplistic assessment methods. With AI assistance, we propose an intelligent teaching architecture based on a teaching/evaluation/feedback cycle. The system integrates dynamic knowledge graphs and adaptive learning engines to achieve personalized knowledge delivery, utilizes virtual simulation and digital twins to overcome practical training limitations, and employs a data-driven approach to establish a process-centered teaching-evaluation-feedback loop. Practical applications demonstrate its effectiveness in visualizing complex principles, simulating processes, and facilitating project-based innovation. The system significantly enhances students' knowledge integration, engineering thinking, and problem-solving capabilities, providing new insights for curriculum reform under engineering education accreditation. The implementation results from a semester-long case study show a 27.3% improvement in knowledge mastery and a 42% increase in practical skills success rate, validating the system's efficacy in bridging the theory-practice gap.

Keywords: AI; Post-Lithium Battery Course; Intelligent teaching; Teaching system

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1. Introduction

The rapid evolution of the new energy industry and lithium-ion battery technology creates increasing demands for professional training. Traditional teaching models fail to effectively illustrate micro-electrochemical principles or provide adequate practical experience due to cost and safety constraints. Student assessment remains limited to theoretical examinations, unable to evaluate engineering innovation capabilities. Although educational reforms like Outcome-Based Education (OBE) have been implemented, they still cannot achieve personalized learning and process-oriented evaluation. Artificial intelligence technologies, with their capabilities in data mining, content analysis, and virtual simulation, offer solutions to these challenges. This research aims to construct an AI-empowered teaching system to enhance educational effectiveness and cultivate talent meeting

industry requirements. This paradigm shift is critical as global investments in energy storage are projected to exceed \$300 billion by 2030, creating an urgent need for a highly skilled workforce proficient in next-generation battery technologies. The convergence of AI and pedagogy represents a transformative opportunity to reengineer engineering education from a static knowledge-transfer model into a dynamic, adaptive, and experiential learning ecosystem.

2. Teaching status of Post-Lithium Battery Courses and the necessity of AI empowerment

Lithium-ion battery technology is essential for modern new energy development and has become a key component in materials, chemistry, chemical engineering, and related disciplines. However, its course content is highly theoretical and practical, posing significant challenges for traditional teaching methods. Core concepts such as material microstructure, electrochemical mechanisms, and manufacturing processes are difficult to convey through textbooks alone. Students struggle to visualize dynamic processes like lithium-ion migration, leading to poor conceptual understanding. Furthermore, constraints like limited lab space, high costs, and safety concerns restrict hands-on activities such as battery assembly and testing, creating a gap between theory and practice. Although teaching reforms like Outcome-Based Education (OBE) and integrated scientific philosophy have been introduced, they still fall short in enabling personalized learning and providing timely feedback, as highlighted in the teaching reforms discussed by Jin et al. (2023) ^[3]. The emergence of artificial intelligence (AI) offers a promising solution. AI technologies—including machine learning, knowledge graphs, and virtual simulation—can create dynamic, interactive teaching environments. They transform abstract concepts into visual models, convert high-risk experiments into safe virtual training, and generate personalized learning paths based on student behavior analysis. This AI-driven approach represents a fundamental shift in teaching philosophy, aiming to enhance effectiveness and cultivate talent ready for the energy industry's future needs. Specifically, the integration of natural language processing (NLP) enables automated extraction and structuring of knowledge from vast and rapidly evolving sources such as research papers (e.g., from Nature Energy or Advanced Materials) and patent databases, ensuring the curriculum remains at the technological forefront. Furthermore, computer vision algorithms can analyze student engagement and confusion levels in real-time during virtual operations, allowing for instantaneous adaptive support, a feature impossible to achieve in traditional settings.

3. Overall construction of the AI-empowered intelligent teaching system for Post-Lithium Battery Courses

3.1. Core philosophy of the system

The system's foundational philosophy centers on student development and capability achievement, constructing a data-driven, dynamically optimized teaching paradigm that transcends traditional linear knowledge transmission. It addresses core challenges in lithium-ion battery education, including theoretical abstraction, practical disconnection, and assessment limitations. Through dynamic knowledge graphs, the system transforms static content into living networks that integrate cutting-edge industry and research developments, ensuring synchronous evolution with technological progress. Virtual simulation and digital twin technologies create immersive, risk-free environments where students experiment with process parameters and understand their impact on performance, transforming abstract principles into operational engineering intuition. Crucially,

multidimensional data collection and analysis form an intelligent closed loop that enables adaptive learning paths and data-informed teaching adjustments, achieving organic unity between scale cultivation and personalized development. This philosophy is underpinned by a constructivist learning theory, which posits that knowledge is actively built by the learner through experience. The system acts as a cognitive scaffold, guiding students from concrete experiences (virtual experiments) to abstract conceptualization (theory) and active experimentation (project design), thereby fostering deeper, more durable learning. The ultimate goal is to cultivate T-shaped professionals with both deep technical expertise in battery technology and broad systemic thinking abilities.

3.2. Functional design of core modules

The system integrates three core modules: intelligent cognitive construction, virtual simulation training, and data-driven assessment. The cognitive module employs dynamic knowledge graphs to transform course content into interconnected visual networks, continuously updated with cutting-edge research through an adaptive learning engine that tailors paths based on student interactions. The virtual training platform uses high-fidelity modeling and digital twin technology to simulate battery production processes, allowing parameter adjustment with real-time performance feedback and intelligent error analysis. The assessment system collects comprehensive process data to generate multidimensional ability profiles, providing personalized feedback and teaching optimization support through dynamic dashboards and analytics. Together, these modules create an integrated teaching-learning-evaluation ecosystem that adapts to individual needs while maintaining systematic coherence. For instance, the adaptive learning engine specifically employs a hybrid recommendation algorithm combining collaborative filtering (“students who struggled with SEI film formation also found these resources helpful”) and knowledge tracing models that map a learner’s mastery of prerequisite concepts like electrochemical potentials to their ability to grasp more advanced topics like fast-charging protocols. The digital twin platform is built on a multi-physics simulation core that simultaneously solves coupled equations for ion transport, heat generation, and mechanical stress, providing students with a holistic view of battery behavior under complex operating conditions similar to the virtual training approaches explored by Yang et al. (2022) ^[4].

3.3. Technical support and integration path

The system builds upon a layered, service-oriented architecture that organically integrates intelligent algorithms, teaching resources, and business logic through standardized interfaces. The infrastructure layer leverages cloud computing’s elastic capabilities and containerization for scalable deployment. The data/algorithm layer features a unified data platform that cleanses and integrates multimodal teaching data into valuable assets. Machine learning models operate here for knowledge graph updating, path recommendation, and ability assessment, continuously optimizing through data learning. The core capability layer encapsulates these algorithms into reusable microservices exposed via API gateways. The three application modules are developed as independent units calling shared microservices, while message queues enable data exchange and business linkage, forming a tightly coordinated closed loop. The architecture follows open standards for future extensibility and employs CI/CD pipelines for agile iteration, ensuring long-term viability amid educational transformations. A typical data flow begins when a student interacts with a knowledge node on “solid-state electrolytes.” This interaction event is captured by the data platform, triggering the recommendation microservice. The service queries the student’s profile and, using a matrix factorization model, identifies relevant research papers on sulfide-based electrolytes. Simultaneously, it signals the virtual simulation service to pre-load a related experiment module for ionic conductivity measurement. This seamless, event-driven integration ensures a fluid and responsive learning experience, eliminating the friction

typically associated with switching between different learning tools and platforms.

4. Practical application of AI technology in specific teaching scenarios of Post-Lithium Battery Courses

4.1. Visualized teaching of abstract principles

In the Post-Lithium Battery Course instruction, AI-powered dynamic visualization transforms abstract principles into intuitive cognitive tools that effectively address micro-electrochemical teaching challenges. Molecular dynamics simulations and 3D animation rendering enable magnified demonstration of lithium-ion intercalation/deintercalation and migration processes within electrode lattices, allowing students to observe ion diffusion paths and concentration changes under different states of charge. Multi-physics coupling models visualize real-time potential distribution, current density variations, and temperature field evolution during charge/discharge processes, converting abstract electrode reaction kinetics into interactive imagery that helps students establish essential connections between macroscopic performance and microscopic interface reactions. For invisible processes like solid electrolyte interphase formation, machine learning potential-based simulations dynamically display molecular and electron cloud reconstruction, correlated with actual capacity decay curves to help students understand microscopic mechanisms while mastering their impact on cycle life. This immersive visualization reduces cognitive barriers while enabling autonomous exploration of material-process-performance relationships through interactive parameter adjustment and immediate feedback, deepening core principle understanding through active inquiry. For example, students can manipulate the crystallographic orientation of a nickel-rich cathode particle (e.g., NMC811) within the simulation and immediately observe the resulting anisotropic expansion and the consequent development of microcracks during lithium insertion, directly linking material microstructure to mechanical degradation and capacity fade—a relationship nearly impossible to grasp from static textbook images alone as demonstrated in the visualization techniques employed by Liu et al. (2023) ^[2].

4.2. Simulation training for complex processes

AI technology creates breakthrough practical training through high-precision digital twin systems that address traditional limitations in safety and cost. The platform mirrors real production lines using virtual reality to physically model and dynamically simulate entire processes from electrode slurry preparation and coating to cell assembly and electrolyte filling. Students operate virtual equipment immersively while observing inter-process connections, autonomously adjusting key parameters like slurry solid content, coating speed, and compaction density. The system employs multi-physics coupling algorithms to simulate real-time impacts of these adjustments on electrode microstructure and final battery performance, generating immediate visualized data reports. When process deviations like uneven coating or excessive rolling occur, intelligent guidance compares operations against standards to suggest optimizations and analyze failure mechanisms. Safety modules simulate extreme conditions, including thermal runaway and electrolyte leakage, systematically training emergency response capabilities akin to the safety training modules developed by Yang et al. (2022) ^[4]. This deep integration of real-time decision feedback with result verification enables valuable production experience accumulation in risk-free environments, effectively cultivating engineering optimization abilities and quality control awareness. A key training scenario involves optimizing the calendaring process: students adjust the roller pressure and temperature, and the simulation calculates the resulting electrode porosity and tortuosity using empirical models. The system then feeds these structural parameters into a Newman-type electrochemical model to predict the

cell's rate performance, creating a direct, quantifiable link between a manufacturing decision (pressure) and a key product metric (C-rate capability). This “process-structure-performance” chain is central to battery engineering and is mastered through repeated, consequence-free experimentation.

4.3. Project-based innovation design

This teaching segment applies AI technologies to construct a comprehensive innovation practice from demand analysis to solution optimization. The system analyzes industry and academic trends to intelligently generate challenging yet feasible problems, such as developing high-energy-density cathodes or designing fast-charging systems. During solution conception, knowledge graphs provide curated references while generative AI assists in material selection, structural design, and process route screening. The core design phase employs multi-scale simulation tools for high-throughput virtual screening of electrode formulations and cell configurations, while AI engines use machine learning to predict electrochemical performance and multi-objective optimization to balance energy density, cycle life, and cost trade-offs. Following simulation verification, digital twin platforms create virtual prototypes that provide data on rate performance and thermal management, with system-identified design flaws and corrective guidance. This end-to-end practice enables students to experience collaborative brainstorming, simulation verification, and iterative optimization, developing systematic thinking and interdisciplinary integration capabilities while participating in the complete innovation chain to enhance complex problem-solving abilities. In a typical project, a student team might be tasked with designing a high-energy-density cell for electric aviation. The AI system first provides a curated knowledge base on lightweight materials and high-voltage electrolytes. The team then uses generative design tools to explore thousands of possible electrode thickness and porosity combinations. An AI-powered multi-objective optimizer, employing algorithms like NSGA-II, helps them navigate the trade-offs between energy density (Wh/kg), power density (W/kg), and cycle life, ultimately presenting a Pareto front of optimal solutions. Finally, they create a digital twin of their chosen design to simulate performance under realistic flight profile loads, receiving instant feedback on critical issues like temperature hotspots under high-current discharge.

5. Case study and effectiveness evaluation

5.1. Implementation case: Application in the “Post-Lithium Battery Materials and Technology” course

This study implemented the AI-empowered teaching system in the general course “Post-Lithium Battery Materials and Technology” over one semester. The course was designed for a diverse student body, with no restrictions on major or academic year. The case study involved 95 students divided into an experimental group using the intelligent system and a control group following traditional teaching methods. Over 32 credit hours, the experimental group utilized the dynamic knowledge graph for autonomous learning of core concepts such as cathode material crystal structures and lithium-ion migration mechanisms. In the virtual simulation platform, students completed key process modules including electrode slurry viscosity optimization, coating uniformity control, and formation cycle testing. The project-based innovation design segment tasked students with optimizing the energy density of an NMC811 cathode material system, requiring them to navigate trade-offs between specific capacity, tap density, and cycle stability through iterative simulation following the project-based framework established by Huang et al. (2023) ^[1]. The instructional design followed a flipped classroom model, where students first acquired foundational knowledge autonomously through the AI system, freeing up classroom

time for interactive discussions, deep dives into complex phenomena like voltage hysteresis, and collaborative problem-solving sessions focused on the AI-generated project challenges, thereby maximizing the value of face-to-face interaction.

5.2. Quantitative analysis of teaching effectiveness

A multi-dimensional evaluation system was employed to quantitatively assess the teaching outcomes. Pre- and post-test assessments revealed that the experimental group's average score on knowledge mastery increased by 27.3% compared to the control group's 11.5% improvement. In practical ability assessments, students using the digital twin platform achieved a 42% higher success rate in process parameter optimization tasks. Analysis of innovation capability, evaluated through project reports and design solutions, showed that the experimental group demonstrated significantly greater proficiency in proposing alternative material systems and conducting multi-objective optimization. A survey on learning engagement indicated that 89% of students in the experimental group reported a deeper understanding of the intrinsic links between process parameters and battery performance, attributing this to the immediate feedback provided by the AI system. Furthermore, correlation analysis of learning behavior data revealed a strong positive relationship ($r = 0.72, p < 0.01$) between the frequency of using the knowledge graph for exploratory learning and final comprehensive assessment scores. A detailed analysis of the project reports using a rubric scored on a 100-point scale showed that the experimental group outperformed the control group by an average of 15 points, with the most significant differences observed in the "justification of design choices" and "analysis of trade-offs" criteria, indicating a marked improvement in critical engineering judgment and decision-making skills consistent with the assessment methodologies validated by Jin et al. (2023)^[3].

5.3. Discussion on implementation challenges and optimization strategies

Despite the significant advantages demonstrated, the implementation process also revealed several challenges. Firstly, the initial construction of high-fidelity virtual simulation models requires substantial computational resources and interdisciplinary expertise, presenting a high barrier to entry. Secondly, the effective operation of the adaptive learning engine depends on a critical mass of student interaction data, meaning its optimization effect is more pronounced in the later stages of course delivery. Additionally, the system's demand for instructor AI literacy necessitates targeted training, as some instructors initially struggled with data interpretation from the teaching dashboard. To address these challenges, future iterations will incorporate lightweight modeling techniques to reduce computational load, implement incremental learning algorithms to accelerate model optimization, and develop an AI-assisted teacher guidance module that provides interpretable analytics and instructional suggestions. These strategies aim to lower the implementation threshold while enhancing the system's practicality and scalability across different institutional contexts. For example, to tackle the data dependency issue, the system will be pre-trained on anonymized interaction data from pilot programs, using transfer learning techniques to provide a baseline level of personalization from the very first cohort of students at a new institution. Furthermore, a community platform for educators will be established to share and collaboratively refine simulation modules and assessment rubrics, fostering an ecosystem of continuous improvement and reducing the development burden on any single institution, as suggested in the collaborative models proposed by Liu et al. (2023)^[2].

6. Conclusion

This study constructs an AI-empowered intelligent teaching system that effectively addresses core challenges

in traditional lithium-ion battery instruction through organic integration of dynamic knowledge graphs, virtual simulation platforms, and data-driven assessment. The system achieves structured, dynamic knowledge delivery, creates safe and efficient practical environments, and establishes multidimensional continuous improvement mechanisms. Practice demonstrates significant advantages in enhancing learning outcomes, engineering literacy, and innovation capabilities. The system provides a concrete pathway and reference model for engineering education digital transformation, with future work exploring deeper technology integration and broader disciplinary application. The empirical case study and quantitative evaluation further validate the system's significant value in enhancing teaching quality and cultivating innovative talent. The success of this system underscores the transformative potential of AI in moving engineering education from a one-size-fits-all model to a personalized, experiential, and evidence-based paradigm. Future research will focus on longitudinal studies to track the long-term career impact on graduates and on developing standards for interoperability between different AI-powered educational tools to create a more open and flexible learning technology landscape.

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Research on Silence in Online Classroom and Its Countermeasures: A Conversational Analysis Approach

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Abstract: As an effective application of educational technology, online classrooms became the predominant teaching mode nationwide and globally during the pandemic and even after. In the post-pandemic era and future education landscape, their role is becoming increasingly vital. Both in-person and online classrooms exhibit widespread silence, with online classrooms showing particularly pronounced silence. However, this silence phenomenon in classroom teaching has not received adequate attention. This study employs conversation analysis to conduct case studies on silence phenomena in university English online classrooms, supplemented by empirical research through questionnaire surveys, providing feasible strategies to enhance teaching efficiency in higher education English courses.

Keywords: Online classroom; Conversation analysis; Silence phenomenon; English teaching

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1. Introduction

For decades, the phenomenon of silence has remained largely overlooked in academic research. This cultural phenomenon has existed since ancient times, as evidenced by idioms about silence across different cultures. The Chinese proverb “Silence is golden” traces its origins to ancient Egypt and now appears in Chinese, English, and German idioms. In Chinese educational contexts and broader Asian culture, classroom silence was commonplace, particularly in traditional classrooms before the 1990s, where “quietness” symbolized students’ attentive listening and marked classroom success. With evolving teaching philosophies and the implementation of Communicative Language Teaching (CLT), student engagement has become a priority. However, decades of silence cannot be reversed overnight. The recent pandemic shift from in-person to online learning has exacerbated this issue, with students citing more excuses like “I couldn’t hear the teacher clearly” or “I’m too busy” as reasons for avoiding participation. Silence, as a form of discourse behavior, has emerged as an interdisciplinary subject. While traditional classroom silence and gender-related research are well-documented, studies on online classroom silence remain scarce. Teachers’ questions often go unanswered, and students rarely volunteer responses. To

address this challenge effectively, we should first understand the dynamics of online classroom silence during and after the pandemic, enabling us to develop targeted solutions.

2. Research background and methods

The research project on classroom silence emerged during the COVID-19 pandemic, inspired by online learning experiences. Participants who completed four months of online courses recognized that traditional “classroom silence” went against modern language pedagogy and even challenged the concept of interactive teaching ^[1]. Collaborating with instructors, they developed this study focusing on online classroom silence, a phenomenon unprecedented in the pandemic era’s digital learning landscape. Previous research focused on real classrooms, with no prior studies on online silence ^[2]. This paper employs two methodologies: conversation analysis and questionnaire surveys, combining theoretical explanation with empirical evidence. Through case studies and data-driven insights, it establishes a scientific foundation for enhancing online classroom effectiveness. The research comprises two components: classroom conversation analysis and questionnaire analysis ^[3].

3. Conversation analysis and results of the silence phenomenon

The following are three categories of silence phenomena obtained through conversation analysis, which have different results on classroom conversation and teaching strategies ^[4].

3.1. Case 1

At the beginning of an oral class, the teacher and students analyze a passage between A and B, and analyze the emphasis function of “echoing” in the dialogue:

Teacher: What does Echo mean?

Student: (S1)..... (6 seconds)

Teacher: What does “to echo something” mean?

Student: (S2).....(4 seconds) Echo.

Teacher: Yes, “echo”, right? Is that what it is? You repeat something, or shout in a cave or near mountains. Echoing can be for technique to show interest in conversation or encourage people to say more.....

When the teacher first posed a question, the students fell into a six-second silence. To break this silence, the teacher employed an “unfinished dialogue” teaching strategy by asking a follow-up question. This prompted students to actively complete the unfinished statements under the teacher’s guidance, gradually introducing classroom content through a new dialogue structure of “questioning-silence-repetition-feedback”, effectively resolving the silence ^[5].

3.2. Case 2

The following is a sample of an online English reading course:

Teacher: (S1) In this lesson, we also learned about another form of racial discrimination. What is it? Do you remember?... (7 seconds)

Student: Barrier.

Teacher (S2): It’s a barrier, right? It’s the “language barrier”, isn’t it? (Or) what else could it be called?..... (5 seconds)

(S3) A deep class divide. And right now, we have a new word, racial discrimination. (9 seconds)

Teacher: OK, that's all for this paragraph. I don't think this part is very difficult for you, so right now I want to share my screen with you.

The prolonged silence prompted the teacher to either conclude the discussion or shift focus. When the teacher elaborated on the term "barrier", the students remained silent despite a 9-second wait. After several seconds of quiet, the teacher responded to the question and initiated new content^[6]. This silence signaled both the end of the speaking turn and the conclusion of the dialogue.

The analysis shows that in curriculum-centered classrooms, the guiding position of teachers will affect the occurrence of silence, especially when teachers have more classroom control, students' silence is more frequent, even if the teacher asks questions, they seldom respond or even do not respond.^[7]

3.3. Case 3

In a writing class, the teacher and students comment on sentences that need to be revised. In this online class, the teacher asks questions to the students through the microphone, and the students type their feedback into the message panel.

Teacher: (S1) OK, any other mistakes you can find? Come on..... (16 seconds) Other students, can you contribute your answers in the message area?

Student 1: (S2).....(21 seconds) of after add phrase. (Reply)

Teacher: Right. Add a phrase after "of". And what else? As we mentioned before, pay attention to the changes in verb collocations. Can any other students find new mistakes?

Student 2:(S3).....(20 seconds) (gives the wrong answer)

Teacher: There is no problem in this sentence.

Student 3:(S4).....(14 seconds) brought due to something wrong? It seems to be repeated.

Teacher: Right. You got it.

In this scenario, the silence resulted from students' lack of understanding, leading to incorrect answers. When a student provided an incorrect response, the teacher rejected it and offered hints until they got it right. Although the lesson was teacher-led, students actively participated in discussions after receiving guidance. The student's subsequent inquiry about potential issues in the sentence demonstrated both attentive listening to feedback and expressing personal opinions.

When such silence occurs in the classroom, teachers can further explain the content of the question or change the way they ask it to help students correct their mistakes and get the desired response.

3.4. Case 4

Similar situations occurred in the same writing class. The teacher helped students answer questions by emphasizing the "key words" in the questions:

Teacher: Now, let us try to give some definitions to the words. "Pressure". What's the definition of Pressure? It's a concept in physics, right?

Student: (S1).....(27 seconds) Pressure may be defined as a mental emotion that makes people tired and upset.

Teacher: (reading answer) OK, as I mentioned, we just discussed pressure... in physics. Physics. You gave us a definition, but I'm waiting for the concept of pressure in physics. In physics, what does pressure mean? (8.5 seconds)

Student: (S2).....(8.5 seconds) Pressure is a force that comes from the height of the air.

Teacher: Is it just the pressure of the air? Maybe that's part of it. Yeah.

As demonstrated in the case study, when the teacher asked students to define “pressure” physically, the student appeared distracted and gave an incorrect response. To ensure accurate feedback, the teacher repeatedly emphasized key terms to help students grasp the missed content. After the teacher pointed out the error, the student spent approximately 8.5 seconds reflecting before revising their answer, after which the teacher continued providing feedback. This strategy effectively activated the classroom mechanism of “stimulus-response-feedback.”

In the aforementioned cases, the causes of classroom silence are multifaceted. They may stem from students' failure to make sense of questions, problematic questioning techniques, poor teacher-student interactions, or network problems. Compared to traditional classrooms, online learning environments are more prone to silent moments, which hinder effective interaction. Moreover, teachers cannot “monitor” students' learning progress or understand their needs. The limitations of theoretical analysis become evident in this context. To address these issues, the phenomenon of classroom silence requires scientific analysis through methods like questionnaire surveys.

4. Questionnaire analysis and the results

This online survey was conducted from December 1 to January 3, 2020, targeting undergraduate students at science and engineering universities. The questionnaire comprised 16 single-choice questions, 3 multiple-choice questions, and 1 matrix scale item, covering aspects such as personal background, teacher-student relationships, teaching methodologies, question content, and questioning techniques^[8]. Distributed through Wenjuanxing (a Chinese survey platform), the study collected over 160 valid responses from 61 male and 98 female university students. The majority (54.09%) were seniors (86 students), followed by freshmen (9 students), sophomores (15 students), and juniors (49 students). Notably, 109 respondents were non-English majors^[9].

In addition to studying specific classroom cases through conversation analysis, this paper also analyzes the causes of the silence phenomenon based on questionnaire survey results. The main reasons are subjective and objective reasons of students themselves^[10].

4.1. Issues with students

According to the survey results, they mainly involve learning habits, confidence, mentality, classroom learning, and even students' own personalities.

Since middle school, students have been used to passive learning, and they serve as containers, and a large class also limits their participation, fostering a culture of silent patterns. This classroom has deeply ingrained a passive learning mentality where students fail to recognize their active role^[11]. The classroom silence persists even in online settings, where teachers struggle to monitor responses effectively. Whether submitting audio answers or written responses, students' names and class details become visible. Survey reports reveal that 65.41% of students lack confidence, viewing incorrect answers as personal humiliation. Many students exhibit incomplete frameworks and insufficient understanding of questions, leading to silence- no responses at all. Others choose silence due to personality, avoiding public exposure as much as possible.

4.2. Other issues

Online classroom teaching is complicated and is influenced by various other factors, including network conditions, the surrounding environment, teacher-student relationships, classroom atmosphere, and questioning methods. The survey report indicates that teachers' questioning styles, frequency, and types in online classrooms significantly impact classroom dynamics. Data shows 69.82% of respondents prefer group-wide questions, while only 10.69% favor selecting representatives for individual responses. Most participants noted moderate questioning frequency, with approximately 10% either over-questioning or never asking. Both excessive and insufficient questioning can lead to silence, as optimal classroom effectiveness requires balanced questioning. Teachers' questioning approaches also contribute to classroom silence. Compared to analytical questions, students show a preference for yes/no questions at 40.25%. Discordant teacher-student relationships create generational gaps, leading to student dissatisfaction and resistance, which further contributes to classroom silence. Other factors like network instability and platform lag also negatively impact learning outcomes ^[12].

5. Strategies for silence in online class using the voting function

During video conferences, teachers can effectively monitor students' learning process. Video platforms typically feature voting functions, allowing instructors to instantly display questions on the screen for real-time interaction. This approach not only facilitates student supervision but also enables teachers to assess comprehension levels, determine if concepts require re-explanation, and adjust question difficulty in real time. Participation rates through voting help identify active contributors, while teaching pace can be dynamically adjusted based on answer accuracy ^[13]. Furthermore, educators should invest time and effort in creating a relaxed and supportive environment that fosters meaningful teacher-student interactions, empowering students to fully engage as active participants. Timely encouragement and recognition of classroom contributions significantly enhance students' sense of belonging in the learning community.

5.2. Giving full play of language

In English classrooms, teachers can bridge the gap with students through language arts. Humorous remarks help lighten the atmosphere, while eye contact, body language, and facial expressions enhance teacher-student rapport. Educators should actively connect with students by offering encouragement and guidance, while providing timely feedback when they answer questions ^[14]. In online courses, teachers should adapt their roles, acting as both facilitators and collaborators. Maintaining equality, educators should encourage active participation and expressive engagement. Establishing incentive systems further motivates students to voice ideas, fostering enthusiastic classroom participation that achieves the "engaged learning" effect.

5.3. Combining teachers' guidance and students' participation

Students are the central participants in classroom learning and play a pivotal role in English education. Teachers' guidance is demonstrated through managing class dynamics, stimulating critical thinking, and maintaining student engagement. The key to student-centered learning lies in proactive preparation, ensuring thorough pre-class study. A positive teacher-student relationship fosters an effective classroom environment, which requires educators to understand each learner's uniqueness. Teachers should design questions tailored to students' current proficiency levels, encouraging open participation from every student ^[15]. They must avoid assuming an "authoritative" role, instead adopting a learner-centered approach that motivates students to talk, promotes communication, respects individuality, and allows challenges to classroom authority. This collaborative effort

helps build an equal and harmonious atmosphere where all students feel valued and would like to participate.

6. Conclusion

The phenomenon of classroom silence isn't entirely negative. Moderate silence may encourage students to listen attentively, engage in deep reflection, develop critical thinking, and form their own viewpoints. However, excessive silence often carries negative implications: students either remain passive participants or avoid asking questions. In online teaching, teachers should actively assume the role of "facilitators," initiating discussions, adjusting the pace and duration of dialogues, demonstrating both the wisdom to listen and the ability to adapt. By understanding the mechanisms behind silence and implementing scientific strategies, teachers may establish efficient classrooms. Simultaneously, students should actively collaborate, leveraging peer and group resources to build a student-centered community that enhances classroom interaction and discussion participation. Only through joint efforts can teachers and students create a harmonious learning environment.

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AI-Enabled Teaching Reform and Practical Exploration of Compressor Courses

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Abstract: Against the background of the comprehensive advancement of emerging engineering construction and the deepening of industrial intelligent transformation, compressor courses, as core courses for majors such as Energy and Power Engineering, Mechanical Engineering, and Chemical Process Machinery, assume the important task of cultivating students' engineering practice capabilities and innovative thinking. However, traditional teaching models face problems such as the use of abstract theories and a disconnection from practice, which make it difficult to meet the talent training requirements of the new era. Taking the in-depth integration of AI technology and education as the core concept, this paper systematically sorts out the teaching status and reform needs of compressor courses, and constructs an overall framework for "AI + Compressor" course teaching reform from three dimensions: teaching content reconstruction, teaching model innovation, and practical system optimization. By introducing various carriers such as virtual simulation experiments, intelligent teaching platforms, personalized learning systems, and AI innovative practice projects, it promotes the concretization of theoretical teaching, the scaling of practical teaching, and the precision of the teaching process. The paper also discusses the guarantee mechanism for the implementation of the reform, providing a feasible path for cultivating compound talents with engineering practice capabilities, innovative thinking, and intelligent technology application capabilities, as well as a reference paradigm for the intelligent transformation of engineering professional courses in China.

Keywords: AI technology; Compressor courses; Teaching reform; Emerging engineering; Practical teaching

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1. Introduction

Compressor courses cover multiple knowledge modules such as thermodynamics, fluid mechanics, and structural design, featuring a strong theoretical nature, close connection with engineering practice, and rapid knowledge updates^[1,2]. However, against the backdrop of industrial intelligent transformation, traditional teaching methods have gradually revealed various deficiencies: complex formulas and physical models are difficult to intuitively demonstrate, leading to students' understanding difficulties; experimental equipment is large in size and high in cost, resulting in limited actual operation opportunities for students; the update of teaching content lags behind,

with insufficient coverage of intelligent technologies^[3–5]. These problems restrict the improvement of course teaching quality and affect graduates' adaptability to the intelligent needs of the industry.

The development of emerging technologies, such as artificial intelligence, has provided important technical support and transformation opportunities for the teaching reform of computer courses. Using technologies such as artificial intelligence, virtual simulation, and big data analysis can effectively break the limitations of traditional teaching in terms of time, space, and resources, construct an intelligent teaching environment, optimize the teaching process, innovate practical models, and promote the transformation of teaching focus from “knowledge transmission” to “ability cultivation”^[6,7]. Therefore, exploring the in-depth integration of AI technology and compressor course teaching, reconstructing teaching content, innovating teaching methods, and improving the practical system are of great theoretical value and practical significance for improving teaching quality and cultivating high-quality talents adapting to industry development. Combining the actual teaching of compressor courses, this paper systematically expounds the core paths and guarantee measures of AI-enabled teaching reform, providing a reference for the intelligent construction of engineering professional courses.

2. Current teaching status and reform needs of compressor courses

2.1. Analysis of current teaching status

At present, the teaching of compressor courses faces several prominent problems: first, the teaching content is highly theoretical and abstract, involving complex formulas and models related to compressor working principles, thermodynamic processes, and structural design. Traditional blackboard writing and multimedia demonstrations are difficult to vividly show their dynamic processes, resulting in obstacles for students' understanding; second, experimental conditions are limited, and university laboratories are unable to equip sufficient training devices, leading to students' lack of actual operation opportunities and insufficient mastery of key skills such as equipment disassembly and assembly, debugging, and fault diagnosis^[8]; finally, the teaching content fails to keep up with technological development. With the wide application of intelligent sensing, the Internet of Things, AI diagnosis, and other technologies in the compressor field, traditional course content lacks a systematic introduction to intelligent technologies, resulting in a gap with actual industry needs.

2.2. Reform demand orientation

Emerging engineering construction emphasizes the cultivation of students' engineering practice and innovation capabilities, while industrial intelligent transformation puts forward higher requirements for talents' technical application level^[9–11]. The reform of compressor courses needs to meet the following demands: first, knowledge content should keep pace with the times, introducing cutting-edge applications of AI in compressor condition monitoring, fault diagnosis, and operation optimization; second, practical teaching needs to be upgraded, breaking the limitations of equipment and venues, and constructing a large-scale, high-simulation training environment; third, the demand for personalized teaching is increasingly prominent, and precise teaching and guidance should be implemented according to students' cognitive characteristics and learning progress.

3. Core paths of AI-enabled teaching reform for compressor courses

3.1. Reconstruct the teaching content system and integrate cutting-edge AI applications

Teaching content is the core of course implementation, and reconstructing the content system is the foundation

of AI-enabled reform. Guided by industry needs and centered on ability cultivation, a trinity teaching content system of “basic theory + engineering practice + AI application” should be constructed to achieve their organic integration. While consolidating core theories such as thermodynamic principles and fluid mechanics foundations, AI technology is used to realize the visualization of abstract theories. For example, numerical simulation and AI algorithms are used to visualize dynamic changes such as internal flow fields and temperature fields of compressors; virtual simulation animations are developed to simulate working processes such as valve opening and closing and piston movement, converting abstract structural principles into intuitive dynamic images, reducing students’ cognitive difficulty, and stimulating learning interest. At the same time, combined with engineering cases, the specific application processes and methods of AI in compressor condition monitoring, fault diagnosis, and operation optimization are elaborated in detail. Introduce real industry cases to promote the close integration of theory and practice. Select typical engineering cases such as intelligent operation and maintenance, remote monitoring, and energy efficiency optimization, guide students to analyze key technical issues and solutions, apply the learned knowledge to solve practical engineering problems, and cultivate engineering thinking and practical problem-solving abilities.

3.2. Innovate teaching models and realize intelligent teaching interaction

Relying on AI technology to build a diversified and intelligent teaching model, changing the traditional one-way teaching pattern, enhancing the interest, interactivity, and effectiveness of teaching, and realizing the transformation from “knowledge transmission” to “ability cultivation”. Implement a teaching model combining “virtual simulation + real-scene demonstration” to make up for the lack of experimental equipment. Use AI virtual simulation technology to develop a compressor virtual training system covering modules such as structural cognition, disassembly and assembly training, operation debugging, and fault diagnosis: it supports multi-angle observation, operation guidance, and repeated practice to help students master structures and operation processes; the operation debugging module allows parameter adjustment to observe the impact on performance; the fault diagnosis module simulates typical faults to guide students to analyze causes and formulate maintenance plans. At the same time, combine physical equipment for real-scene demonstrations to promote the integration of virtual operations and actual equipment, deepening understanding. Build an intelligent teaching platform to realize precise teaching and personalized learning support. The platform integrates resources such as online courses, virtual experiments, case libraries, and question banks, automatically collects students’ learning data such as learning duration, video viewing progress, and homework completion, and analyzes learning characteristics and weak links through AI algorithms to push personalized learning resources accurately. Use AI Q&A robots to provide 24/7 online Q&A services, and teachers conduct targeted guidance for students with learning difficulties based on platform feedback, realizing “teaching students in accordance with their aptitude.”

3.3. Optimize the practical teaching system and improve engineering application capabilities

Practical teaching is a key link in cultivating students’ engineering application capabilities and innovative thinking. A three-level progressive practical teaching system of “virtual simulation training + physical experiment verification + AI innovative practice” should be constructed to realize the systematic advancement from basic skill training to comprehensive ability improvement, and then to innovative ability cultivation, comprehensively enhancing students’ practical level and innovative quality.

The virtual simulation practice level is mainly oriented to lower-grade students or those with weak practical

foundations. Through immersive and repeatable virtual operations, it helps them master basic practical skills of compressors. The content includes structural cognition, basic operations, and simple fault troubleshooting: in structural cognition training, students familiarize themselves with the names, structures, and assembly relationships of components through the virtual system; basic operation training simulates processes such as compressor start-stop and parameter adjustment to master standardized operations; simple fault troubleshooting training simulates common faults to guide students to analyze causes and formulate treatment plans. This level is not limited by time, space, or equipment quantity, and students can practice repeatedly until they master the skills proficiently^[12,13]. The physical experiment verification level relies on physical equipment in university laboratories to carry out verification and comprehensive experiments, combining virtual simulation results with actual operations. The content mainly includes experiments such as performance testing, structural parameter optimization, and simple fault diagnosis: in the performance testing experiment, students operate physical equipment to measure indicators such as displacement, power, and energy efficiency under different working conditions^[14,15], compare and analyze with virtual results, verify model accuracy, and master instrument usage methods; the structural parameter optimization experiment observes performance changes by adjusting parameters such as valve structure and piston stroke, and analyzes optimization directions combined with theoretical and simulation results; the simple fault diagnosis experiment uses physical equipment to simulate faults, and students use detection methods and instruments for diagnosis to improve actual operation and problem-solving abilities.

4. Guarantee for reform implementation

AI-enabled teaching reform of compressor courses is a systematic project that requires guarantees from multiple aspects, such as teacher team building, teaching resources, management mechanisms, and school-enterprise cooperation, to ensure the smooth implementation and effectiveness of the reform. In terms of teacher team building, focus on cultivating a “double-qualified” teaching team. Organize teachers to participate in training on AI technology and teaching reform to improve their application capabilities. In terms of teaching resource construction, increase investment to develop high-quality intelligent teaching resources. Invest funds to build a highly simulated and practical virtual training system, simulation animations, and experimental projects; cooperate with enterprises to introduce real project cases, operation data, and technical documents to enhance engineering practicality. In terms of teaching management mechanism optimization, establish a flexible and efficient institutional guarantee. Adjust teaching plans and curriculum settings, reasonably allocate class hours, and increase the proportion of practical and AI-related content; formulate online teaching management specifications, clarify the connection method between online and offline teaching, and ensure the quality of blended teaching; establish a teaching reform incentive mechanism to provide policy and resource support for teachers participating in the reform. In terms of school-enterprise collaborative cooperation, construct a production-education integration talent training model. Establish long-term cooperative relationships with compressor manufacturing enterprises and intelligent technology companies, co-build internship and practice bases, and provide real engineering environments; transform enterprise actual projects into teaching cases and practical topics to guide students to participate in real R&D; invite enterprise experts to give lectures and technical guidance to impart cutting-edge industry technology experience.

5. Conclusion

Driven by both emerging engineering construction and industrial intelligent transformation, AI technology provides important technical support and innovative momentum for the teaching reform of compressor courses, and is an effective way to break through traditional teaching bottlenecks and improve teaching quality and effectiveness. This paper constructs a framework for “AI + Compressor” course teaching reform, systematically expounding the in-depth integration path of AI technology and courses from three dimensions of teaching content, model, and practical system to solve traditional teaching bottlenecks. Through the reform, it is expected to realize the concretization of theory, the scaling of practice, and the precision of teaching, cultivating compound talents meeting industry needs. In the future, it is necessary to continuously deepen the integration of AI and teaching, optimize the model and practical system to adapt to technological development and industrial upgrading.

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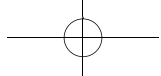
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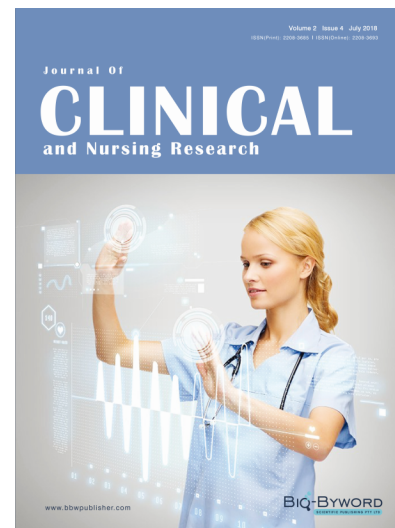
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