

3. Features and advantages of GeoGebra software

3.1. Software features

GeoGebra software boasts an intuitive user interface. Through uncomplicated mouse-click and drag-and-drop maneuvers, users can expeditiously generate a plethora of geometric figures and algebraic expressions. It accommodates a diverse array of drawing modalities, encompassing plane geometry drafting, solid geometry rendering, and function graphing.

During the figure-creation process, the software instantaneously showcases the corresponding algebraic equations, thereby affecting the concurrent manifestation of geometric figures and algebraic equations. Furthermore, GeoGebra software is endowed with robust dynamic demonstration capabilities. Users can manipulate the control points on figures or adjust parameter values to observe in real-time the metamorphoses of the figures and the attendant alterations in the algebraic equations.

3.2. Advantages in analytic geometry teaching

Achieving graphical visualization: GeoGebra software is capable of accurately and clearly depicting various analytic geometry graphs, including plane curves and space surfaces. For complex graphs such as surfaces of revolution and cylindrical surfaces, the software can showcase the generation process of the graphs through dynamic demonstrations. This helps students intuitively understand the formation principles and properties of the graphs^[16].

Promoting the integration of geometry and algebra: In GeoGebra software, geometric graphs and algebraic equations are interrelated. When a user draws a geometric graph, the software automatically generates the corresponding algebraic equation. Conversely, when a user inputs an algebraic equation, the software can quickly draw the corresponding graph. This real-time correspondence between geometry and algebra assists students in deeply understanding the ideological method of combining geometry and algebra in analytic geometry, thus building a bridge between geometric graphs and algebraic equations.

Enhancing students' interaction and participation: GeoGebra software supports students' independent operation and exploration. Students can actively observe the variation patterns of graphs, discover problems, and attempt to solve them by changing the parameters of graphs or dragging the control points of graphs. This interactive learning method can stimulate students' learning interest and initiative^[17] and cultivate their innovative thinking and practical abilities.

4. Necessity and feasibility of visual teaching of analytic geometry based on GeoGebra software

4.1. Necessity of visual teaching of analytic geometry based on GeoGebra software

Aligning with the trend of educational informatization: With the extensive application of information technology in the field of education, using mathematical software to assist teaching has become an inevitable trend in the development of educational informatization. Introducing GeoGebra software into analytic geometry teaching can diversify teaching methods and enhance the level of teaching informatization, meeting the demands of educational development in the new era.

Improving teaching quality and effectiveness: The problems existing in traditional analytic geometry teaching seriously affect teaching quality and effectiveness. The visualization function of GeoGebra software can help students better understand abstract concepts and complex graphs, increasing students' learning interest and efficiency, and thus improving the quality and effectiveness of analytic geometry teaching.

Cultivating students' mathematical literacy: Analytic geometry teaching is not only about imparting knowledge but also about cultivating students' mathematical literacy. The application of GeoGebra software can guide students to observe and think about problems from different perspectives, fostering their spatial imagination, logical thinking, and innovative abilities, and promoting the comprehensive improvement of students' mathematical literacy.

4.2. Feasibility of visual teaching of analytic geometry based on GeoGebra software

Ease of use of the software: GeoGebra software is simple to operate and easy to master. Teachers and students can proficiently grasp the basic operation methods of the software after a short-term study and training. Moreover, the software provides abundant online tutorials and learning resources, which facilitate teachers and students to learn independently and further improve their software application capabilities.

School support and resource guarantee: Kashi University attaches great importance to educational informatization construction and provides necessary support and resource guarantee for teachers to carry out informatized teaching. The school is equipped with complete computer facilities and a network environment, which can meet the needs of teachers and students for using GeoGebra software in teaching and learning. Meanwhile, the school regularly organizes information technology training for teachers to participate in to enhance their software application capabilities and informatized teaching levels.

5. Practice of visual teaching of analytic geometry based on GeoGebra software

5.1. Teaching design

Setting teaching objectives: In the teaching of analytic geometry based on GeoGebra software, teaching objectives should not only enable students to master the basic concepts, theorems, and methods of analytic geometry but also cultivate their abilities to use the software for graph-drawing, analysis, and problem-solving. Through the dynamic demonstrations of the software, students are guided to observe the variation patterns of graphs, fostering their spatial imagination and logical thinking abilities. Meanwhile, it stimulates students' learning interest and innovative consciousness.

Integrating teaching content: Based on the teaching syllabus of analytic geometry courses and the features of GeoGebra software, the teaching content is integrated. The operational skills of the software are organically combined with teaching knowledge points. For example, when explaining the equations of plane curves, the software is used to demonstrate the changes of curves under different parameters, allowing students to intuitively perceive the impact of parameters on equations and graphs. At the same time, some representative practical problems are selected to guide students to use the software to establish mathematical models and solve them, thereby enhancing students' application abilities.

Designing teaching activities: Teaching activities are divided into online and offline parts. In the online part, teachers release teaching videos, software operation tutorials, and preview tasks through the learning platform. Students independently learn software operations and relevant knowledge, and communicate and discuss on the platform. In the offline part, teachers conduct key explanations and demonstration operations in class, and have students carry out group cooperative learning and practical operations. For instance, when explaining space surfaces, teachers first demonstrate the graphs of several common space surfaces through the software, and then let students operate the software in groups, draw space surfaces with different parameters, and analyze their properties. Finally, teachers comment on and summarize students' operation results, deepening students' understanding and mastery of the knowledge.

5.2. Demonstration of teaching cases

Taking the teaching of “Ellipse and Its Standard Equation” as an example:

Creating a context and introducing the new lesson: Teachers use GeoGebra software to showcase real-life examples of ellipses, such as planetary orbits and elliptical-shaped buildings, enabling students to observe the shape of ellipses and experience their applications in real life. Then, teachers utilize the software’s drawing function to draw an ellipse on-site, guiding students to think about how to describe the shape and properties of an ellipse in mathematical language, thus introducing the new lesson.

Exploring new knowledge and constructing concepts: Teachers guide students to operate with GeoGebra software. First, students are asked to draw two fixed points F_1 and F_2 in the software. Then, an arbitrary point P is taken in the plane. By measuring the lengths of $|PF_1|$ and $|PF_2|$, the value of $|PF_1| + |PF_2|$ is calculated. Next, students are asked to drag point P and observe the changes in the value of $|PF_1| + |PF_2|$. When $|PF_1| + |PF_2|$ is a constant value and greater than $|F_1F_2|$, teachers guide students to discover that the locus of point P is an ellipse. In this way, students can experience the formation process of an ellipse firsthand and have a profound understanding of the definition of an ellipse.

Deriving the equation for in-depth understanding: Based on students’ comprehension of the ellipse definition, teachers guide them to establish a plane rectangular coordinate system and derive the standard equation of the ellipse. During the derivation process, teachers use GeoGebra software to display the establishment of the coordinate system and the algebraic operation process, enabling students to visually witness the transformation from geometric figures to algebraic equations. Meanwhile, by altering the positions of the foci and the lengths of the major and minor axes of the ellipse, students can observe the changes in the equation, thus deepening their understanding of the standard equation of the ellipse.

Consolidating practice and expanding application: Teachers design a series of exercises using GeoGebra software, asking students to operate and solve them within the software. For example, students are given the equation of an ellipse and required to draw the corresponding ellipse, or provided with some properties of an ellipse and asked to find its standard equation. Through these exercises, students further reinforce their learned knowledge and enhance their application abilities. Additionally, teachers can guide students to use ellipse-related knowledge to solve practical problems, such as designing an elliptical flower bed, thereby cultivating students’ innovative thinking and practical abilities.

6. Investigation and analysis of the teaching effect of visual teaching of analytic geometry based on GeoGebra software

6.1. Investigation methods

The teaching effect was investigated by combining questionnaire surveys and classroom observations. The questionnaire surveys were mainly targeted at students to understand their attitudes towards the visual teaching of analytic geometry based on GeoGebra software, their learning interest, and their degree of knowledge mastery. Classroom observations mainly focused on students’ participation in class, their proficiency in operating the software, and their performance in group cooperative learning.

6.2. Analysis of investigation results

Students’ learning attitudes and interests: The results of the questionnaire surveys showed that most students had a positive attitude towards the visual teaching of analytic geometry based on GeoGebra software, believing that this teaching method could enhance their learning interest. Classroom observations also revealed that

when students were operating and learning with the software, they were more focused and their participation was significantly improved. This indicates that the application of GeoGebra software has stimulated students' learning interest, transforming them from passive learners to active learners.

Degree of knowledge mastery: Through the analysis of students' homework and exam results, it was found that after the implementation of the visual teaching based on GeoGebra software, students' mastery of analytic geometry knowledge had improved. Especially for some abstract concepts and complex graphs, students were able to better understand their properties and applications through the demonstrations and operations of the software. For example, when learning about space surfaces, students were able to accurately draw the graphs of various space surfaces, analyze their properties based on the graphs, and enhance their ability to solve related problems.

Ability cultivation: Both classroom observations and questionnaire surveys indicated that students' spatial imagination ability, logical thinking ability, and practical operation ability had been exercised and improved during the teaching process. Students could better cultivate their spatial imagination ability by operating the software independently and observing the changes in the graphs. Their logical thinking ability was strengthened during the process of analyzing the relationship between graphs and equations and solving practical problems. Moreover, in group cooperative learning and practical operations, students' practical operation ability and teamwork spirit were also cultivated.

7. Conclusion

Through the practice and investigation analysis of the visual teaching of analytic geometry based on GeoGebra software, the following conclusions are drawn: The application of GeoGebra software in analytic geometry teaching has remarkable advantages. It can effectively enhance the visualization level of teaching, helping students better understand abstract concepts and complex graphs, and strengthening students' learning interest and initiative. Through software operation and practical activities, students' spatial imagination ability, logical thinking ability, and practical operation ability have been cultivated and improved. The teaching model based on GeoGebra software conforms to the development trend of educational informatization, providing new ideas and methods for the teaching reform of analytic geometry.

Although the visual teaching of analytic geometry based on GeoGebra software has achieved certain results, some problems have also been found during the research process. For example, some teachers are not proficient enough in applying the software, which affects the teaching effect; when students use the software for independent exploration, they sometimes deviate from the teaching objectives. Future research can be carried out in the following aspects: Strengthen the training of teachers to improve their software application ability and informatization teaching level; further optimize the teaching design to guide students to use the software more effectively for learning and exploration; carry out the construction of teaching resources for analytic geometry based on GeoGebra software, develop more high-quality teaching cases and teaching courseware to provide richer resource support for teaching. At the same time, the research scope can also be expanded to other mathematics courses to explore the application effects and teaching models of GeoGebra software in the teaching of more mathematics courses.

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Strategies for Enhancing the Digital Academic Service Capacity of Librarians in Vocational Colleges under the Background of New Quality Productivity

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Abstract: With the rapid development of new quality productivity and the in-depth advancement of digital transformation, vocational college libraries, as important supporting institutions for teaching and research, are facing the dual challenges of service model transformation and capacity improvement. Based on the changes in the demand for digital academic services under the background of new quality productivity, this paper systematically analyzes the current situation and problems of the digital academic service capabilities of librarians in vocational colleges, constructs a capability model including four dimensions: cognitive attitude, knowledge reserve, skill application, and communication and sharing, and proposes capability improvement strategies from aspects such as organizational incentives, professional training, service innovation, and technical support. Research shows that librarians in vocational colleges need to comprehensively enhance their digital academic service capabilities through paths such as concept renewal, skill strengthening, service transformation, and environment optimization, in order to adapt to the demands of educational reform in the era of new quality productivity.

Keywords: New quality productivity; Vocational colleges; Librarian; Digital academic services; Ability improvement

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1. Introduction

In the context of the rapid development of new quality productivity, digital transformation has become the core driving force for the high-quality development of vocational education ^[1-3]. As the center of knowledge services in vocational colleges, libraries are undergoing a profound transformation from traditional literature services to digital academic services. Digital academic services refer to a new service model in which librarians utilize digital technologies, tools, and methods to provide full-process and multi-dimensional support for teaching and

research, covering multiple fields such as data management, digital publishing, open science, and academic collaboration^[4,5]. With the in-depth advancement of industry-education integration in vocational colleges and the increasing demand for scientific research, the demands of teachers and students for digital academic services have shown the characteristics of personalization, precision, and full-cycle^[6].

However, there is a significant gap between the current digital academic service capabilities of librarians in vocational colleges and this demand. Most librarians remain at the traditional service level, lacking data thinking, technological application, and interdisciplinary collaboration capabilities, making it difficult for them to effectively support the digital teaching and research activities of teachers and students. This problem not only restricts the exertion of the service efficiency of libraries, but also affects the quality of talent cultivation and scientific research innovation in vocational colleges. Therefore, exploring the improvement path of digital academic service capabilities of librarians in vocational colleges under the background of new quality productivity has important theoretical value and practical significance.

2. Changes in the demand for digital academic services under the background of new quality productivity

The core features of the new quality productivity are digitalization, networking, and intelligence. This trend has profoundly changed the ecosystem and scientific research paradigm of vocational education. Against this backdrop, the demands of teachers and students in vocational colleges for digital academic services have undergone significant changes.

From the perspective of service content, teachers and students are no longer satisfied with simple literature retrieval and delivery, but need comprehensive services covering the entire cycle of scientific research. In the initiation stage of scientific research, trend analysis, hot topic exploration, and topic selection support are needed; During the research process, the support of data collection, processing, and analysis tools is required; During the outcome production stage, services such as open publishing, intellectual property rights, and influence assessment are required. These demands require librarians to possess multiple capabilities such as data literacy, technology application, and disciplinary knowledge.

From the perspective of service methods, teachers and students tend to prefer personalized and proactive services. The traditional passive response mode can no longer meet the demands. Librarians need to go deep into the front line of teaching and research, understand the specific needs of teachers and students, and provide customized solutions. For instance, providing embedded data management services for research teams and developing digital teaching resources for teaching teams, etc.

From the perspective of technological application, the demand of teachers and students for new technological tools is increasing day by day. The application of technologies such as artificial intelligence, big data analysis, and virtual reality in vocational education is constantly deepening. Teachers and students hope that libraries can provide relevant technical training and tool support. For example, text mining technology is utilized to analyze industry trends, and visualization tools are employed to display scientific research achievements.

3. Current situation and problems of digital academic service capabilities of librarians in vocational colleges

Through the analysis of relevant literature and field research, it is found that the digital academic service

capabilities of librarians in current vocational colleges have the following prominent problems:

Insufficient professional ability is the primary bottleneck. Most librarians lack a systematic professional background in library and information science and have limited mastery of the theories and methods of digital academic services. In terms of professional skills, the mastery level of core digital academic skills such as data management, text analysis, and visualization is generally low. Weak technical application ability is a common phenomenon. Although most librarians have basic computer operation skills, their application ability of professional software and tools is insufficient, and the lack of subject knowledge is an important constraint.

The professional settings of vocational colleges usually have distinct industry characteristics, and the demands of teachers and students are highly specialized. However, librarians have limited knowledge of the relevant industries and find it difficult to accurately grasp the actual needs of teachers and students.

The lagging service concept is a deep-seated obstacle. Some librarians still adhere to the traditional service concept and have an insufficient understanding of the necessity and value of digital academic services. In terms of service attitude, there is a lack of initiative and innovation, as well as awareness of going deep into the front line of teaching and research. This conceptual lag is often more difficult to overcome than technical shortcomings.

The imperfect training system is an important issue. Libraries in vocational colleges generally lack a systematic training plan for librarians. The training content is fragmented, the methods are monotonous, and the effect is limited. In particular, specialized training for digital academic service capabilities is seriously insufficient, and there is a lack of effective support for the improvement of librarians' capabilities.

4. Construction of the digital academic service capability model for librarians in vocational colleges

Based on the analysis of the demand for digital academic services and the characteristics of vocational college libraries, this paper constructs a digital academic service capability model for vocational college librarians consisting of four levels.

The cognitive attitude layer is the foundation of ability development, including four dimensions: digital awareness and thinking, cognition of digital academic value, cognition of digital academic needs, and awareness of digital skill reconstruction. This level emphasizes librarians' understanding of the necessity of service transformation in the context of new quality productivity and their willingness to proactively adapt to changes. Librarians in vocational colleges need to establish a "user-centered" service concept and understand the profound impact of digital transformation on vocational education.

The knowledge reserve layer serves as the support for capability development, encompassing four dimensions: digital academic knowledge, library and information science knowledge, computer network knowledge, and specialized knowledge in specific disciplines. Librarians in vocational colleges not only need to master the basic knowledge of library and information science, but also need to understand the development dynamics and technological trends of related industries, and form a compound knowledge structure of "library and information science knowledge + disciplinary knowledge + digital knowledge."

The skill application layer is the core of capabilities, encompassing four dimensions: the application of digital technology, the creation of digital content, problem-solving and innovation, as well as digital learning and development. In terms of technology application, it is necessary to master skills such as data collection, cleaning, analysis, and visualization. In terms of content creation, it is necessary to be capable of developing

digital teaching resources, building thematic databases, etc. In terms of problem-solving, innovative thinking and practical ability are required. In terms of learning and development, it is necessary to maintain a continuous learning attitude and ability.

The communication and sharing layer is about capability expansion, encompassing five dimensions: teaching and training, project management, collaborative communication, dissemination and marketing, and security protection. Librarians in vocational colleges need to have the ability to train teachers and students and be capable of organizing digital academic activities. It is necessary to master project management methods and coordinate multiple resources. It is necessary to be good at communicating with teachers and students and accurately grasp the demands. It is necessary to promote the service achievements and expand the influence. Attention also needs to be paid to data security and intellectual property protection.

5. Strategies for enhancing the digital academic service capabilities of librarians in vocational colleges

In view of the current situation and problems of the digital academic service capabilities of librarians in vocational colleges, combined with the capability model, this paper proposes the following improvement strategies.

5.1. Fostering a digital academic service culture

Conceptual guidance is the prerequisite. The leadership of the library should fully recognize the importance of digital academic services, incorporate them into the library's development strategy, and convey the necessity and vision of service transformation to librarians through various means. Special topic seminars can be organized to analyze the challenges and opportunities of new quality productivity in vocational education and help librarians establish a digital service mindset.

Stress relief is the key. The improvement of digital skills may bring anxiety and stress to librarians. Libraries should establish support mechanisms, such as setting up a technical mentorship system to provide one-on-one guidance for librarians; establish mutual assistance groups to promote the sharing of experiences; allocate work tasks reasonably to avoid overburdening librarians.

5.2. Building a systematic training system

The training content should cover all dimensions of the capability model. At the cognitive attitude level, carry out training on digital academic concepts. At the knowledge reserve level, organize training on professional knowledge of library and information science, industry knowledge, and digital technology knowledge. At the level of skill application, the focus is on strengthening practical skills training such as data analysis, visualization, and digital content creation. At the level of communication and sharing, enhance the teaching and training, project management, and communication and coordination capabilities of librarians.

The training methods should be diversified. In addition to traditional lectures and courses, more emphasis should be placed on practical training methods. Project-based learning can be carried out to enable librarians to master skills through actual projects. Organize workshops and conduct practical skills training. Establish a digital academic laboratory to provide a platform for technical experience and practice.

Training resources should make full use of both on-campus and off-campus resources. Joint training can be carried out in collaboration with the information technology department and teaching and research units within the school. Off-campus, one can participate in training activities organized by industry alliances and the Library

Working Committee. Digital learning resources such as MOOCs and online courses can also be utilized to provide flexible learning opportunities for librarians.

5.3. Promoting the transformation of service models

Embedded services are an important direction. Librarians should go deep into departments and research teams to understand the actual needs of teachers and students and provide customized services. For instance, participate in the data management of scientific research projects, support the teaching team in developing digital resources, and provide information support for skills competitions, etc.

Data service is the core content. Vocational college libraries should establish a scientific research data service system, including services such as consultation on data management plans, support for data storage and sharing, and training on data analysis tools. A school-based data warehouse can be built to store and manage the research data of teachers and students.

Open science services are an emerging field. Libraries should promote the concepts of open access and open data, and assist teachers and students in sharing research results in compliance. Build an institutional knowledge base to centrally display the academic achievements of the school. Provide intellectual property consultation to help teachers and students protect their innovative achievements.

5.4. Optimizing the digital service environment

The tool platform is the fundamental support. Libraries should be equipped with necessary software tools such as data analysis and visualization, build digital academic service platforms, and integrate functions such as resource retrieval, data analysis, and achievement display. It is possible to cooperate with industry enterprises and introduce digital tools that meet the needs of vocational colleges.

The practice community is an important carrier. Establish a digital academic service practice community to promote experience sharing and collaborative innovation among librarians. The community can regularly organize activities such as technical salons and case sharing to create a good learning atmosphere.

The cooperative network is an expansion approach. Strengthen cooperation with libraries of other institutions, public libraries, and industry enterprises, and share resources and experiences. Participate in regional or national digital academic service alliances, learn advanced practices, and enhance service capabilities.

6. Conclusion

Against the backdrop of the rapid development of new quality productivity, enhancing digital academic service capabilities has become an inevitable choice for librarians in vocational colleges to adapt to the demands of the times. The implementation of these strategies requires the attention of the library leadership, the policy support of the school, and the active participation of librarians. Through paths such as concept renewal, skill enhancement, service transformation, and environment optimization, librarians in vocational colleges will be able to comprehensively improve their digital academic service capabilities, better support the teaching and research work of the schools, and make greater contributions to cultivating high-quality technical and skilled talents.

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Research on the Teaching Practice of Integrated Science and Education in Pharmacy Comprehensive Experiment Based on Regional Characteristics

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Abstract: The integration of science and education represents the organic fusion of scientific research with educational instruction, constituting a critical trend in the advancement of modern higher education. This integration not only enhances teaching quality but also drives innovation in scientific research and fosters high-caliber talent development. The curriculum team has carefully selected experimental content from recent scientific research outcomes that aligns with students' core courses, features an appropriate level of difficulty, incorporates interdisciplinary and regional characteristics, and demonstrates innovativeness, practicality, and scientific rigor. This content is systematically incorporated into the talent cultivation process, enabling students to fully comprehend the principles of pharmaceutical research through hands-on experimentation. Furthermore, it strengthens students' experimental operational skills and cultivates their spirit of scientific inquiry, thereby achieving superior teaching outcomes.

Keywords: Regional characteristics; Integration of science and education; Pharmacy comprehensive experiment

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1. Introduction

The integration of science and education represents a mode that organically combines scientific research with educational instruction, playing a vital role in the teaching process for undergraduates. It introduces the latest scientific research achievements into the classroom, aligning theoretical teaching content with practical work. Teachers convert their own research topics into teaching cases, helping students visualize abstract theoretical knowledge and understand the latest developments in the discipline. This not only enriches the teaching content but also stimulates students' interest in learning ^[1]. The integration of science and education provides students

with opportunities to participate in scientific research practices. By engaging in teachers' research projects or laboratory work, students can apply the theoretical knowledge learned in the classroom to practical problems, enhancing their experimental operational skills and scientific thinking. This practical learning contributes to cultivating students' innovative and problem-solving abilities, laying the foundation for their future academic research or career development. Additionally, the integration of science and education promotes interdisciplinary learning and the cultivation of comprehensive abilities. Scientific research projects often involve the integrated application of multidisciplinary knowledge, allowing students to broaden their horizons and enhance their interdisciplinary thinking abilities during the participation process. Meanwhile, components of scientific research activities, such as teamwork, literature retrieval, and data analysis, also help improve students' overall scientific literacy ^[2-5].

2. Background of setting up comprehensive experiments through the integration of science and education

In the traditional pharmaceutical education system, the experimental teaching of core courses such as medicinal chemistry, pharmacology, pharmaceutics, and pharmaceutical analysis has long been mutually independent. Although each discipline has set up verification experiments, the barriers between disciplines have made it difficult to achieve organic integration of the knowledge system. After completing their professional courses, students often struggle to systematically integrate key technical links such as drug synthesis, activity screening, formulation technology, and quality control when facing the needs of actual drug development. This "island of knowledge" phenomenon significantly affects the cultivation of students' scientific research thinking abilities, resulting in issues such as fragmented experimental design and unsystematic technical routes during their internship stage. Addressing this teaching challenge and constructing a comprehensive experimental system that integrates science and education has become an important direction for the reform of pharmaceutical education ^[6-8].

The curriculum team has attempted to break traditional disciplinary boundaries using the entire drug development process as a chain, adopting a modular design to organically connect drug discovery, pharmacodynamic evaluation, formulation development, and other links. Each module maintains its professional characteristics while forming a logical closed loop through the transmission of experimental data, enabling students to intuitively understand the synergistic relationships between disciplines ^[9,10]. The teacher team needs to establish an interdisciplinary lesson preparation mechanism and jointly optimize technical connection points through regular discussions and exchanges on experimental projects.

3. Design ideas for comprehensive experiments through the integration of science and education

The design of comprehensive experiments through the integration of science and education requires comprehensive consideration of the interdisciplinary nature, research conversion, and diverse goals for student ability cultivation. The design should cover the entire process of drug discovery, evaluation, formulation, and quality control. Following the principle of research feeding back into teaching, the teachers' research achievements are converted into teaching cases ^[11]. When constructing a comprehensive experimental system for pharmacy through the integration of science and education, selecting appropriate experimental projects is crucial. Firstly, the difficulty of the experiments needs to be moderate, fully considering the current knowledge and skill levels mastered by most students. The experimental design should stimulate students' interest in

learning and exploration without being too difficult to discourage them. The experimental content should match students' knowledge reserves, allowing them to gradually delve deeper and consolidate and expand theoretical knowledge through practice. Secondly, experiments should be continuous, connecting the knowledge and skills of multiple disciplines.

Through continuous experimental design, students can gradually construct a complete pharmaceutical knowledge system in practice. Additionally, the experimental cycle should not be too long, and experimental results should be obtainable within a relatively short period. Pharmaceutical experiments often require a significant amount of time and effort, but if the experimental cycle is too long, students may lose interest and patience. Therefore, the design of experimental projects should focus on efficiency, preferably selecting experiments that can be completed and yield preliminary results within a relatively short period. This can provide timely feedback on the experimental effects, allowing students to see the results of their efforts within a short time, enhancing their sense of achievement and self-confidence in learning. At the same time, this aligns with the fast-paced requirements of modern higher education, cultivating students' practical abilities and innovative thinking within a limited time. Incorporating regional characteristics is also an important consideration for selecting experimental projects. Many regions in China are rich in unique medicinal material resources, which not only have distinct medicinal values but are also closely related to local culture and economic development. Therefore, experimental projects should be as closely combined with the research and development of regional medicinal materials as possible, enabling students to participate in the research and development of their hometown's medicinal materials. Through this approach, students can not only learn pharmaceutical professional knowledge and skills but also gain a deeper understanding of their hometown's medicinal material resources, enhancing their sense of identity and belonging to their hometown, and subsequently increasing their enthusiasm and sense of responsibility to serve their hometown. In summary, when selecting comprehensive experimental projects for pharmacy through the integration of science and education, multiple factors such as experimental difficulty, continuity, cycle, and regional characteristics need to be comprehensively considered.

4. Content construction of comprehensive experiments integrating science and education

The course group to which the authors belong selected Tianshan Viola as the experimental research object through a comprehensive evaluation. Tianshan Viola is a characteristic medicinal material in Xinjiang. It is distributed in Tianshan Mountain, Kunlun Mountain, and other places in Xinjiang. It is widely used among the people, mainly for colds, fevers, furuncles, carbuncles, lymphadenopathy, and other diseases. The teachers of the course group are committed to the development and utilization of this medicinal material. They have conducted a series of scientific research explorations around this drug and accumulated rich scientific research results. Through research, it was found that this medicinal material contains a variety of compound components, among which flavonoids and polysaccharides show significant antioxidant and antibacterial effects. Through network pharmacology research, combined with database data and Cytoscape software analysis, the team revealed that Tianshan Viola has a significant inhibitory effect on inflammatory response, bacterial infection, tumor cell growth, and melanin production, especially the targets of multiple components are closely related to anti-inflammatory efficacy, which provides a theoretical basis for subsequent experiments. On this basis, the teaching team further separated and purified the flavonoid active ingredients in Tianshan Viola and verified its

efficacy through anti-inflammatory experiments. Finally, it was prepared into a convenient gel, and a quality evaluation standard based on high-performance liquid chromatography (HPLC) was established. Based on the above foundation, the course group took the research and development of Tianshan Viola, a characteristic medicinal material in Xinjiang, as the starting point, and designed the preparation and quality evaluation experiment of Tianshan Viola gel. The specific experimental design is as follows.

4.1. Medicinal chemistry: Investigation of medicinal material extraction and purification process

The experiment first cleans and crushes the Tianshan Viola, removes impurities, and sets it aside. In terms of extraction process optimization, the Box-Behnken central composite design was used in combination with the response surface method to comprehensively optimize the ultrasonic extraction conditions of total flavonoids from *Viola tianshanica* in order to improve the extraction rate of total flavonoids. The experiment used the total flavonoid content as an indicator, optimized the ultrasonic extraction conditions through single-factor experimental investigation and response surface analysis, and finally determined the optimal extraction process. In terms of the purification process, macroporous adsorption resin was used to separate and purify the extracted total flavonoids from *Viola tianshanica*. Macroporous resin has the advantages of high physical stability, good adsorption selectivity, simple regeneration, and low cost, and is suitable for industrial production^[12]. The experiment investigated the adsorption and desorption properties of four macroporous resins—AB-8, D101, NKA-9, and S-8. Through static adsorption tests and dynamic tests, the adsorption amount and other indicators were calculated to screen out the best purification resin type to achieve efficient enrichment of total flavonoid components from *Viola tianshanica*.

4.2. Pharmacology: Anti-inflammatory experiment of medicinal extracts

In order to verify the anti-inflammatory effect of the total flavonoid extract of *Viola tianshanica*, an acute inflammation model was constructed using Kunming mice. There was a blank control group (normal saline), a positive drug control group (dexamethasone), a low-dose administration group, a medium-dose administration group, and a high-dose administration group. The experiment used the xylene-induced mouse ear swelling model, which is characterized by local vasodilation and increased capillary permeability. It is mainly used to evaluate the effect of drugs on the early stage of inflammation. By comparing the groups, statistical analysis was performed to evaluate the anti-inflammatory effect of *Viola tianshanica* extract.

4.3. Pharmacy: Preparation process of Viola tianshanica gel preparation

Viola tianshanica has significant therapeutic effects in the treatment of carbuncle swelling and pain. In order to better exert its medicinal value, the experiment prepared its alcohol extract into a topical gel. The gel has the advantages of slow and uniform drug release and convenient administration, and is suitable for the treatment of local skin diseases. Combined with the results of the previous preliminary experiment, the prescription and dosage of the gel matrix were determined. Through orthogonal experiments, xanthan gum was used as the main material to investigate the optimal ratio of hydrogel, and the formability and water loss rate were used as evaluation indicators for weighted scoring. According to the optimized conditions, the prepared Tianshan Viola gel should be yellow, clear, uniform, semi-solid, with moderate viscosity, non-irritating to the skin, fast film formation, and no abnormal odor.

4.4. Drug analysis: Quality standard investigation of Tianshan Viola gel preparation

Tianshan Viola contains a variety of active ingredients, among which quercetin and kaempferol are closely related to its efficacy and have a high content, and are selected as quality evaluation indicators. Quercetin is a coumarin component, and kaempferol is a flavonoid component. The experiment used high-performance liquid chromatography to determine the content of quercetin and kaempferol in the gel. At the same time, repeatability tests, precision tests, and sample recovery tests were carried out to verify the accuracy, precision, and specificity of the method. Content standards were formulated based on literature records and previous explorations. The test results were used to determine whether the preparation met the quality standards, and the preliminary quality evaluation of the Tianshan Viola gel was completed^[13,14].

5. Arrangement of comprehensive experiments integrating science and education

In the concentrated practice phase of the pharmacy major, the course group designed a four-week comprehensive experimental project to comprehensively improve students' professional literacy and practical ability. The experimental project takes the preparation and quality evaluation of Tianshan Viola gel as the core content. Through scientific and reasonable experimental arrangements and teaching methods, students can fully exercise their abilities in literature review, experimental design, practical operation, data analysis, and report writing within a limited time. The entire comprehensive experimental project is divided into four stages, corresponding to the core contents of the four disciplines. The first week is the drug chemistry part, which mainly studies the extraction and purification process of Tianshan Viola; the second week enters the pharmacology stage to verify the anti-inflammatory effect of the extract; the third week conducts pharmacy experiments to prepare gel preparations and optimize the prescription; the fourth week focuses on drug analysis and conducts quality evaluation of the gel. Since the experiment was rich in content and had a large workload, students were divided into groups in advance, with each group consisting of 4–5 students, to ensure that each group member could fully play their role in the experiment. This group-based collaborative teaching model not only gave students a clearer understanding of the experimental content but also cultivated their teamwork spirit and independent learning ability. The cultivation of this collaborative spirit of solving problems in a team is of great significance to students' future career development.

6. Evaluation of the effect of comprehensive experiments integrating science and education

Teaching practice shows that this model significantly improves students' comprehensive scientific research literacy. Through questionnaire surveys, it was found that 90% of students believed that multidisciplinary cross-experiments helped to establish systematic research and development thinking, and 95% of participants said that they improved their literature research and program design capabilities. In terms of the quality of experimental reports, students' scores improved by 40%. What is more noteworthy is that students participating in the project showed stronger technical integration capabilities in their graduation project research, and the first-time pass rate of graduation papers increased by 15% compared with previous years. After two rounds of teaching practice, this experiment has significantly improved students' experimental operation level and scientific thinking, with significant results. Students' learning enthusiasm has increased, and their interest in experimental operations has become stronger.

The comprehensive experiment integrating science and education is suitable for students majoring in

pharmacy, clinical pharmacy, and pharmaceutical engineering. The experiment involved basic knowledge such as literature review, data statistics, and animal modeling, and exercised experimental operation skills such as ultrasonic extraction, high-performance liquid chromatography, and column chromatography. It cultivated students' ability to analyze and solve problems. This experiment combined local medicinal plant resources with practical applications, improved students' learning enthusiasm, and played a good leading and exemplary role in helping students to enter internship positions and better carry out scientific research. It is an effective form of cultivating college students' practical and innovative abilities.

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Reform and Practice of Integrated Teaching of Remote Sensing and Geographic Information System Courses for Geographical Science Majors Oriented to National Land Space Planning

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Abstract: Based on the outcome-based education concept, the integrated teaching of professional courses for land space planning in the human geography and urban and rural planning majors was reformed and practiced. Focusing on the fundamental task of “establishing morality and cultivating people,” the reform of the teaching mode was proposed to clarify the industry needs, revise and improve the training program and teaching syllabus, innovate the teaching mode, and optimize the practical teaching resources and conditions. A new “multi-dimensional, interactive, and three-dimensional” teaching mode was constructed, and the integrated teaching method of enterprise projects, professional internships, and scientific research training was innovated, realizing the talent training mechanism of “demand-driven and integration of industry and education.”

Keywords: Outcome-based education concept; National land space planning; Human geography and urban and rural planning; Higher education

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1. Introduction

In recent years, the continuous development and widespread application of technologies such as cloud computing, big data, and artificial intelligence have put forward higher requirements and challenges for classroom teaching in colleges and universities. Remote sensing (RS) and geographic information system (GIS) courses are offered in majors such as geographical science, physical geography and resources and environment, human geography and urban and rural planning, and geographic information science. In order to adapt to the needs of society and improve the competitiveness of education, the construction and application of modern classrooms is the general trend ^[1]. Guided by the “National Standards for Teaching Quality of Undergraduate Majors in Ordinary Colleges and Universities,” with the goal of building applied undergraduate majors, and

with “cultivating morality and educating people” as the fundamental task, the reform and practice of integrated teaching of RS and GIS courses in geographical science majors for national land space planning is a positive response to the “Guiding Opinions on Guiding Some Local Ordinary Undergraduate Colleges and Universities to Transform into Application-Oriented Majors,” and a beneficial exploration of the transformation and development of local ordinary colleges and universities.

2. Main problems in teaching

2.1. Extensive and complex teaching content and inconspicuous professional characteristics

In the current remote sensing and geographic information course teaching, the content covers a wide range and many knowledge points. The course setting pursues a large and comprehensive subject system, which includes both basic geographical theories and application skills such as programming and remote sensing technology, but lacks core courses that focus on industry needs^[2]. RS and GIS should be the key technologies to support ecological sustainability research, but they are often used only as tools in teaching, and are not deeply related to specific application fields such as national land planning and environmental monitoring, and the professional characteristics are not prominent.

2.2. Unrelated basic and professional courses and teaching content

Remote sensing courses and geographic information system courses are interrelated, and the arrangement of related courses needs to ensure orderliness and logic. Basic courses such as geography and surveying are set as independent modules with professional courses such as remote sensing technology and GIS spatial analysis, and no progressive knowledge chain is formed. Basic courses are still mainly based on knowledge memorization, while professional courses directly require the ability to solve complex spatial problems. The transitional teaching link of “simple case simulation-real scene migration” is missing in the middle, resulting in students’ knowledge being relatively scattered and not forming a complete knowledge system. Ultimately, the cultivation effect of students’ comprehensive application ability and thinking ability is poor^[3].

2.3. Abstract teaching content and limited teaching methods

The theories of electromagnetic wave radiation transmission and atmospheric correction involved in remote sensing teaching rely on abstract mathematical formulas and physical models, and lack dynamic visualization tools to display the energy transfer process^[4]. GIS topology analysis is mostly based on static diagrams or text descriptions and cannot dynamically display the impact of node connectivity changes on path planning, making it difficult for students to understand the dynamic correlation of spatial relationships. Courses mostly rely on PPT presentations and software operation demonstrations, without combining virtual simulation laboratories or real-life three-dimensional modeling platforms, resulting in students only mastering basic tool operations and lacking the ability to solve complex spatial problems.

2.4. Disconnect between teaching content and industry practice and students’ weak practical application ability

Teaching is still mainly based on traditional desktop software such as ArcGIS and ENVI 5.3^[5], and cloud tools such as ArcGIS Online and Google Earth Engine are not introduced, resulting in students being unable to master distributed computing and collaborative workflow construction skills. Experimental data are mostly static GeoTIFF images or Shapefile vector data, and do not involve new data forms such as real-life 3D models and spatiotemporal databases. In industry practice, the demand for real-life 3D modeling has reached 62%.

Technology application scenarios mostly remain at basic mapping and simple spatial analysis, and are not connected to actual project needs, such as natural resource rights registration and smart city traffic simulation, resulting in 60% of students believing that the skills they have learned are out of touch with their positions ^[6].

3. Strategies for solving teaching problems

3.1. Conducting in-depth research in local areas and enterprises to clarify industry needs

In order to solve the problem of “lack of professional characteristics,” an in-depth research in local front-line enterprises and institutions with RS and GIS as core components of national land space planning technology has shown widespread and continuously growing demand in multiple industry fields.

3.1.1. Natural resources and ecological environment management

In the field of resource monitoring and assessment, RS obtains data on land cover, forest resources, land use, etc., in real time through platforms such as satellites and drones, providing a dynamic data source for GIS. In the field of disaster warning and emergency response, GIS integrates multi-source data to conduct resource distribution analysis, environmental carrying capacity assessment, and ecological restoration planning. RS monitors the dynamic changes of natural disasters in real time. GIS predicts the impact range of disasters through spatial modeling and formulates emergency plans, which are applied to disaster risk assessment and post-disaster reconstruction ^[7].

3.1.2. Urban planning and smart cities

In the field of urban space optimization, RS provides high-resolution image data. GIS combines population, transportation, economic, and other data to assist urban planning decisions. In the field of intelligent management, GIS integrates the Internet of Things and sensor data to build an urban information platform to support intelligent applications such as traffic dispatch, public facilities management, and pollution monitoring ^[8].

3.1.3. Agriculture and precision agriculture

In the field of crop monitoring and yield prediction, RS uses multispectral and thermal infrared remote sensing to identify crop growth, pests and diseases, and soil moisture. GIS combines meteorological and topographic data to generate farmland management zoning maps to guide precise fertilization and irrigation. In the field of land resource management, GIS analyzes changes in arable land quality, and RS dynamically monitors illegal occupation of arable land to ensure food security and sustainable land use ^[9].

3.1.4. Integration of emerging technologies and industry expansion

In the field of cloud computing and big data, RS relies on cloud computing platforms to process massive data, and GIS combines big data technology to explore spatial laws and promote in-depth applications in smart cities, climate change research, and other fields. In emerging fields such as carbon neutrality, digital twins, and metaverse, RS and GIS provide a spatial database to support interdisciplinary needs such as carbon emission monitoring and virtual scene construction ^[10].

3.2. Revising and improving the training program and teaching syllabus, and strengthening the connection between the course teaching content

In order to solve the problem of “lack of connection between course teaching content,” based on in-depth

research, the talent training program and teaching syllabus were revised and improved based on the OBE concept, following the principle of step-by-step progression to strengthen the connection between course content^[11]. The first year mainly offers basic courses such as physical geography, basic geology, cartography, remote sensing principles and applications, and land resources. Through the teaching of the basic elements of the natural environment and their mutual relationship, a good concept of human-land coordination and sustainable development is established; through the teaching of basic theories such as GIS and RS, the acquisition and processing skills of natural resource data are mastered. The second year mainly offers professional courses such as urban planning principles, economic geography, GIS principles and applications, digital mapping, land management, and land economics. Through the teaching of urban planning, economic geography, and land management courses, a good planning and management knowledge system and thinking are established; through the teaching of GIS spatial analysis and mapping, the data analysis and processing methods of resources and planning are mastered. The third year mainly offers industry integration courses such as ecology, planning CAD, national land space planning, urban and rural planning GIS application, urban and rural planning management regulations, and big data technology. Through actual case teaching and the integration of cutting-edge technologies such as big data, practical application capabilities can be improved.

3.3. Building school-based characteristic resources and innovating teaching models

In order to solve the problem of “insufficient teaching methods,” we have built online courses such as “Physical Geography,” “Cartography,” “Remote Sensing Principles and Applications,” “GIS Principles and Applications,” “Land Resources Management,” and “Surveying and Mapping (City) Geographic Information Virtual Simulation Experiment” platform and other teaching resources based on the Super Star platform. In order to adapt to the requirements of outcome-oriented education, the following five transformations should be achieved^[11]: from indoctrination classroom to dialogue classroom, forming knowledge exchange and interaction, “question mark” classroom, to stimulate students’ enthusiasm for learning; from closed classroom to open classroom, forming an extension from in-class to extracurricular, from classroom to library and laboratory, and from textbooks to reference materials; from knowledge classroom to ability classroom, ability classroom is to form high-level knowledge through high-level teaching activities; from emphasizing learning and neglecting thinking to combining learning and thinking, which requires critical thinking, thinking is the key to innovation; from emphasizing teaching and neglecting learning to teaching as the main thing to learning, teaching students to “enjoy learning,” “know how to learn,” and “learn,” and “how well we teach” should be evaluated by “how well we learn.”

3.4. Deepening school-enterprise cooperation and optimizing practical teaching resources and conditions

In order to solve the problem of “disconnection between classroom teaching content and industry practice,” the school-enterprise cooperation internship bases that have been established include Leshan Natural Resources Bureau, Leshan Housing and Urban-Rural Development Bureau, Sichuan Lihang Surveying and Mapping Co., Ltd., etc. In order to better adapt to social needs and promote the development of disciplines, under the background of industry-education integration, deepen school-enterprise cooperation, introduce enterprise projects into the classroom, combine real training projects with teaching, and combine project practice with professional learning to cultivate practical, application-oriented, and innovative talents with both theoretical knowledge and practical skills^[12]. At the same time, comprehensively consider integrating the existing scattered

course practice and professional internships, and through comprehensive practical training and scientific research ability training, train and exercise students' comprehensive application ability of theories, methods, and technologies of relevant professional courses, so that students can consolidate the basic theories and experimental skills learned in class ^[13].

4. Promotion and application of the results

4.1. Significant achievements in professional construction

The Human Geography and Urban and Rural Planning major was approved as the 2023 Leshan Normal University undergraduate professional construction progressive cultivation project "Excellent Professional Team Construction." "Deepening the Universal Sharing Research on Ideological and Political Teaching of Human Geography and Urban and Rural Planning Majors in the New Era" was approved as the 2021–2023 Sichuan Higher Education Talent Training Quality and Teaching Reform Project. In 2022, "Physical Geography" was approved as a provincial-level ideological and political demonstration course, "Surveying and Mapping (Urban) Geographic Information Virtual Simulation Experiment" was approved as a provincial-level first-class course, and "Physical Geography" was approved as a school-level first-class course. In addition, there are more than 10 curriculum reform projects, such as the construction of an intelligent application practice base based on the integration of Haochen Software and GIS. The teaching team has published six teaching and research papers, such as Land Management Course Teaching Reform Research under the Background of Big Data. The teaching team has participated in more than 10 related teaching and research academic conferences, such as the 10th Cartography and Geographic Information System Academic Conference, and the "Remote Sensing Digital Image Processing" Course Teaching and Resource Construction Exchange Conference in Colleges and Universities.

4.2. Significant improvement in the quality of applied talent training

There are 86 students in the 2018 class of Human Geography and Urban and Rural Planning, with a pass rate of more than 70% for CET-4, 35% for CET-6, and 90.55% for Mandarin. They have been awarded the titles of "Excellent Learning Style Class at School Level" and "Advanced Class at School Level" by Leshan Normal University. Students have successfully applied for more than 20 provincial and national innovation projects and published five academic papers. More than 10 students have won national awards in the 9th, 11th, and 13th National College Students' GIS Application Skills Competition, Internet+, "Challenge Cup," and other competitions, 10 provincial first prizes, and more than 30 second prizes and winning prizes. Six students have obtained the Sichuan Provincial College Students' Comprehensive Quality A-level Certificate, one student has won the National College Students' Self-improvement Star, and six students have won the Sichuan Provincial Outstanding University Graduates and the School Outstanding Graduates. 13 students of the 2018 class of this major were admitted to the postgraduate entrance examination, and 11 students of the 2019 class were admitted to the postgraduate entrance examination. The internship units, such as Leshan Natural Resources Bureau, Leshan Urban and Rural Planning and Design Institute, Sichuan Lihang Surveying and Mapping Co., Ltd., etc., gave high praise to the talent training.

4.3. Strong cooperation between schools and universities

The undergraduate major of forestry at Leshan Normal University offers courses such as "Forestry Remote Sensing and Geographic Information System" and "Forestry Remote Sensing and Geographic Information

System Practice.” The undergraduate major of geography science offers courses such as “Physical Geography,” “Cartography,” “Remote Sensing Principles and Applications,” and “GIS Principles and Applications.” The total number of students attending the courses has reached more than 500. The School of Engineering and Technology of Chengdu University of Technology offers undergraduate majors in geographic information science and urban and rural planning, and offers courses such as cartography, digital mapping, urban remote sensing, geographic information systems, land use master planning, and urban master planning. The total number of students attending the courses has reached more than 300. It has carried out more than 10 exchanges and cooperation with the School of Tourism and Geographical Sciences in teaching and research, student training, practical teaching, subject competitions, professional internships, and local services. In-depth exchanges and discussions have been carried out on how to expand the integration of industry, academia, and research, effectively promote the high-quality development of Leshan’s industries, strengthen the construction of scientific research teams, effectively promote the improvement of teaching quality, and subject construction and professional evaluation.

5. Conclusion

In view of the current teaching difficulties, we are guided by industry needs, take industry-education integration and school-enterprise cooperation as breakthroughs, streamline teaching content, and highlight professional characteristics. Reconstruct the curriculum system according to the OBE concept, revise and improve the talent training plan and curriculum syllabus, and ensure the inheritance of the teaching content of basic and professional courses. Innovate the teaching model, carry out classroom teaching reform guided by skill and process assessment, build a batch of school-based characteristic teaching resources, enrich teaching methods, and promote the visualization and concretization of teaching content. Deepen school-local and school-enterprise cooperation, optimize practical teaching resources and conditions, give play to the effectiveness of collaborative education, and enhance students’ practical ability. A talent training mechanism of “demand-driven, industry-education integration” has been established, forming an integrated teaching reform and practice of “outstanding professional characteristics, close course connection, rich and specific content, and school-enterprise collaborative education.”

Disclosure statement

The authors declare no conflict of interest.

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Mismatch between Reality and the NCFSE 2023: Focusing on the Pedagogical Challenges Faced by the Foundational and Preparatory Stage Teachers

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Abstract: Teacher education at the foundational and preparatory stages plays a crucial role in shaping early childhood learning experiences. The National Curriculum Framework for School Education (NCFSE) 2023 provides a structured pedagogical approach to address challenges in these stages. However, despite these policy frameworks, teachers in Kendriya Vidyalayas (KVs) continue to face numerous pedagogical challenges. This paper aims to explore and analyze the pedagogical challenges encountered by KV teachers in foundational and preparatory stage classrooms and compare them with the challenges addressed in NCFSE 2023. Using qualitative research methods, data were collected through structured online interviews with 10 KV teachers from different campuses. This paper investigated various challenges, including classroom management, language barriers, a lack of inclusive education strategies, insufficient infrastructure, limited parental involvement, and difficulties in integrating technology into teaching practices. The findings highlight the gap between policy recommendations and ground-level implementation. Based on these insights, the study suggests recommendations such as specialized teacher training, recruitment of special educators, improved infrastructure, enhanced parental engagement, and policy-driven interventions to bridge the gap between policy frameworks and real-world classroom experiences. The study concludes that addressing these challenges through targeted reforms can create a more inclusive and effective learning environment, fostering holistic student development at the foundational and preparatory stages.

Keywords: Foundational stage teachers; NCFSE 2023; NEP 2020; Pedagogical challenges; Preparatory stage teachers

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1. Introduction

Teacher education at the foundational and preparatory stages plays a pivotal role in shaping early learning experiences. Education serves as the cornerstone of societal development, with teachers playing a pivotal role

in shaping young minds. At the foundational and preparatory stages, teachers lay the groundwork for a child's cognitive, emotional, and social growth. However, despite the importance of these early years, teachers often encounter significant pedagogical challenges that hinder effective teaching and learning. These challenges range from curriculum restrictions and infrastructure, resource limitations to classroom management difficulties and varied educational requirements of students ^[1].

The NCFSE 2023 offers a comprehensive pedagogical blueprint that emphasizes innovation, inclusivity, quality, and responsiveness to diverse learner needs ^[1]. However, discrepancies often exist between such policy frameworks and the realities on the ground ^[2]. This study examines the pedagogical challenges addressed in NCFSE 2023 and the pedagogical challenges faced by the Kendriya Vidyalayas (KVs) teachers in real classroom settings. Understanding the pedagogical challenges faced by teachers at these critical stages is essential for improving teaching methodologies and strategies, fostering student engagement, and enhancing overall learning outcomes. The evolving landscape of education, influenced by technological advancements ^[3], changing pedagogical strategies, and diverse classroom dynamics, further complicates the role of teachers. Addressing these challenges requires a thorough investigation into the key difficulties experienced by educators and the factors contributing to them.

This study aims to identify and analyze the primary pedagogical challenges encountered by teachers at the foundational and preparatory stages. By exploring these issues, the research seeks to provide insights that can reform policy recommendations, teacher training programs, and classroom interventions. The findings of this study will contribute to the ongoing discourse on improving foundational and preparatory stage education, ultimately benefiting both teachers and learners.

2. Methodology

This paper adopted a qualitative research methodology. For the data collection technique, a structured online interview was conducted via Google Meet and WhatsApp video call. Other data have been collected from the policy documents (NCFSE 2023 and NCFFS 2022) ^[4,5]. A structured schedule was developed and used individually online. The tool consists of:

- (1) How do teachers manage classrooms with both children with special needs (CWSN) and gifted students?
- (2) How does classroom overcrowding affect student learning outcomes?
- (3) What are the challenges faced by teachers in teaching children with special needs (CWSN) without special educators?
- (4) How does the language difference between teachers and students impact classroom communication and the learning process?
- (5) What are the major difficulties in implementing experiential learning in foundational stage classrooms?
- (6) What challenges do teachers face in conducting play-based learning activities for young students?
- (7) How does the lack of content in textbooks affect the reading interest of young learners?
- (8) How does the complexity of language in foundational and preparatory stage books affect student comprehension?
- (9) What are the communication challenges?
- (10) What difficulties do teachers and students face in adapting to new educational technologies in

schools?

- (11) How does parental involvement influence student academic progress?
- (12) In what ways does a student's family background affect their academic performance?
- (13) What are the common behavioral challenges faced by teachers in preparatory stage classrooms?
- (14) How does the teacher care for the students?
- (15) What are the major infrastructure challenges faced by students and how do they impact learning?
- (16) How does a high teacher-student ratio affect the learning approaches?

3. Participants

The participants were informed about the purpose of this study, and they were willing to participate in the interview for this study. Some participants responded through WhatsApp messages for their convenience (due to the Public broad exam period). 10 KV (PM SHRI Kendriya Vidyalaya) foundational and preparatory stage teachers participated and encountered their pedagogical challenges. Three teachers were from Karaikal campus, one teacher from Kanpur campus, and others from Puducherry, Kalapet campus.

4. Objectives

The purpose of this study was to find out the mismatch between reality and the NCFSE 2023 on focusing on the pedagogical challenges faced by the foundational and preparatory stage teachers.

5. Pedagogical challenges addressed in NCFSE 2023 for foundational and preparatory stage teachers

The National Curriculum Framework for School Education (NCFSE) 2023 highlights the importance of building a solid educational foundation by tackling key pedagogical challenges encountered by teachers in the foundational stage (ages 3–8) and preparatory stage (ages 8–11) ^[5].

- (1) Teachers often struggle with designing and implementing age-appropriate teaching methodologies. NCFSE 2023 provides a framework that aligns instructional strategies with children's cognitive, emotional, and social development, ensuring learning remains engaging and effective.
- (2) A major challenge in foundational education is supporting language development in a multilingual classroom environment. The framework encourages the use of the mother tongue or local language as the medium of instruction at this stage, allowing children to develop literacy skills naturally before transitioning to additional languages.
- (3) Many teachers face difficulties in integrating play-based learning with academic content. NCFSE 2023 encourages hands-on learning through storytelling, music, games, and interactive activities, creating an engaging and enjoyable educational experience for children.
- (4) A lot of teachers follow traditional assessment at the foundational stage. Traditional assessment methods often fail to capture the diverse learning needs of young children. The framework suggests a shift from rote memorization to formative assessments through observation, portfolios, and performance-based evaluations, thus fostering a more comprehensive understanding of a child's progress.
- (5) Addressing the diverse learning needs of children, including those with special educational requirements, remains a challenge for teachers. NCFSE 2023 advocates for inclusive education by

equipping teachers with strategies for differentiated instruction, ensuring that all children receive equal learning opportunities. Additionally, it emphasizes the importance of creating a supportive and inclusive classroom environment that fosters collaboration, empathy, and individualized attention to cater to varying learning styles and abilities.

- (6) A lack of adequate training often hinders teachers' ability to implement innovative pedagogical approaches. The framework highlights the importance of continuous professional development, encouraging workshops, peer-learning opportunities, innovative pedagogical strategies, and digital resources to enhance teachers' skills.
- (7) With rapid advancements in technology, integrating digital tools, digital literacy into the classroom remains a challenge, especially in the foundational and preparatory stage. NCFSE 2023 supports the use of digital learning resources while maintaining a balance between screen time and hands-on experiences, ensuring technology enhances rather than replaces interactive learning.
- (8) Many teachers struggle with ensuring parental participation in the learning process. The framework underscores the role of parents and the community in a child's education, recommending regular parent-teacher interactions, workshops, awareness programs, and collaborative learning initiatives.

6. Pedagogical challenges faced by the KV foundational and preparatory stage teachers

Balancing diverse learning needs: Managing a classroom with both children with special needs (CWSN) and gifted students poses a significant challenge for KV teachers. Differentiated instruction is essential to cater to the diverse learning paces and abilities, requiring teachers to balance personalized attention and curriculum standards effectively. There should be proper training for foundational stage teachers to handle differentiated instruction ^[6].

Overcrowded classrooms impact learning: Student strength is the biggest challenge. Overcrowded classrooms make it difficult for teachers to provide individual attention, assess student progress, and implement interactive teaching methodologies. This problem impacts the overall learning environment at the foundational stage, leading to a lack of engagement and participation among students.

Lack of special educators for CWSN: Children with special needs (CWSN) require specialized teaching approaches and trained professionals. The absence of dedicated special educators in many KV schools makes it challenging for regular teachers to effectively address the unique learning needs of these students ^[6].

Language barriers in teaching: KV teachers' mother tongue is different from the students. Language barriers between teachers and students create communication gaps, affecting comprehension and classroom interaction and involvement. When the teacher's mother tongue differs from the students' native language, it becomes difficult to facilitate meaningful discussions and enhance linguistic, communication skills effectively ^[7].

Challenges in implementing experiential learning: Experiential learning is difficult in the foundational stage. While NCFSE 2023 promotes experiential learning, implementing hands-on activities and real-life experiences in the foundational stage can be challenging due to limited resources, large class sizes, and time constraints.

Difficulties in play-based learning implementation: Play-based learning, essential for early education, requires clear and simple instructions. However, many KV teachers struggle to effectively communicate play-based learning activities in both foundational and preparatory stages due to a language barrier, leading to

confusion among students.

Lack of visually engaging textbooks: Foundational stage books are not colorful. The lack of visually appealing and engaging textbooks makes it difficult for young learners to stay interested in reading. Additionally, accessibility issues, such as insufficient copies, inappropriate book placement, or inappropriate content, further hinder students' learning experiences.

Complex language in educational content: Most of the teachers acknowledged that the language used in foundational and preparatory stage books is beyond the level of the students. Much educational contents are written in a language that surpasses the comprehension level of students, making it difficult for them to grasp concepts effectively. This problem leads to dependency on teachers and reduces independent learning opportunities among students ^[7].

Communication gaps: Effective communication between teachers, students, and parents is crucial for a smooth and proper educational process. However, communication gaps often exist due to language barriers, cultural differences, or a lack of parental involvement, impacting students' academic progress ^[8].

Adapting to technological advancements: Technological up-gradation by teachers and students to the current scenario is a difficult task. Keeping up with the latest educational technology and content is a challenge for both teachers and students in KV schools. Limited digital literacy, inadequate infrastructure, and lack of proper training prevent the seamless integration of technology into the learning process. Nowadays, attendance, assessment marks, daily lesson plans, and activities should be uploaded to an official portal, which poses a big challenge for teachers after their teaching hours ^[3].

Limited parental involvement in student progress: Teachers face difficulties in monitoring every student's progress without parental involvement. The lack of active parental supervision at home negatively impacts children's academic performance and behavioral development. However, many KV teachers report that parents are either too busy or unaware of their role in supporting their child's education, leading to learning gaps. Student monitoring should be done by parents as well ^[1].

Influence of family background: Family background largely affects the students' learning process. A child's home environment significantly influences their academic process. Socio-economic factors, parental education levels, and home support play crucial roles in shaping a student's learning abilities and overall performance at the foundational and preparatory stage.

Behavioral management: Teachers were sometimes unable to control students' behavior in the preparatory stage. They often struggle with managing student discipline, especially in large classrooms. Behavioral issues, including inattentiveness, over naughtiness, aggression, and lack of interest, pose challenges in maintaining a supportive learning environment ^[2].

Lack of personalized attention: In some cases, students feel neglected due to a lack of teacher engagement, care, and personalized attention. Overburdened teachers with administrative responsibilities often struggle to focus on the emotional and academic needs of every child. It largely affects children with special needs.

Infrastructural limitations: Many KV schools face infrastructure challenges, including inadequate classrooms, a lack of proper seating arrangements, no proper funding, and insufficient learning materials. Poor infrastructure directly affects the quality of education, student engagement, and the learning process.

Teacher-student ratio: Sometimes, a high teacher-student ratio makes it difficult to implement student-centered learning approaches in the preparatory stage. Insufficient teachers in comparison to student strength result in ineffective classroom management and reduced learning outcomes ^[9].

These are the pedagogical challenges faced by the KV teachers. Though the NCFSE 2023 recommended

the stage-specific and subject-specific pedagogical strategies that are not being achieved by the teachers in reality.

7. Recommendations

Specialized training should be provided for teachers to handle diverse student needs, including CWSN and gifted students, ensuring effective differentiated instruction in the classroom. Schools should work towards reducing student-teacher ratios to improve individual attention and learning outcomes. Dedicated special educators should be recruited to support CWSN and assistant teachers in implementing inclusive education strategies foundational and preparatory stage. Language training should be given to teachers ^[7]. Conduct language enhancement programs for teachers to bridge communication gaps between them and students. NCFSE 2023 has provided a lot of pedagogical strategies for language education, which should be implemented strictly in all schools ^[6]. Schools should improve infrastructure, ensure the availability of colorful and engaging books, and provide adequate learning materials and content ^[1]. Schools should adopt innovative teaching methods and strategies, including experiential learning, within the constraints of classroom size and resources. NCFSE 2023 has suggested various teaching strategies for the foundational and preparatory stages, which should be followed regularly in all schools.

There should be regular workshops and training sessions on digital tools and online learning platforms to support teachers in adapting to technological advancements. School administration should organize regular awareness programs to emphasize the importance of parental involvement in students' education at the foundational and preparatory stages ^[1]. Policymakers, school authorities and educators, and the community should work collaboratively to provide a proper foundation in education, career guidance, and mentoring for students. Every school should introduce behavioral management workshops to equip teachers with skills to handle discipline issues effectively ^[2]. Special workshops should be given to foundational teachers on hospitality and caring towards children.

8. Conclusion

This study clearly provides the pedagogical challenges addressed in NCFSE 2023 and the pedagogical challenges faced by the KV teachers at the foundational and preparatory stages. NCFSE 2023 provides a comprehensive roadmap for overcoming key pedagogical challenges by suggesting effective pedagogical strategies at the foundational and preparatory stages. This study found that there is a lack of effective implementation of such pedagogical strategies in schools in reality. The challenges faced by KV teachers highlight the urgent need for reforms in foundational and preparatory stage education. Addressing these issues through teacher training, infrastructural improvements, curriculum adaptations, and increased parental involvement will significantly enhance the quality of education. By implementing these recommendations, not only KV schools but every school can create a more inclusive, engaging, and student-friendly learning environment, ensuring holistic development for every child.

Disclosure statement

The authors declare no conflict of interest.

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Exploration and Research on the Recognition and Transformation of Learning Achievements in the Context of Higher Vocational College Enrollment Expansion

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Abstract: The recognition and transformation of learning outcomes is a key step in building a lifelong learning pathway to meet the personalized and diverse learning and development needs of individuals. In response to the problems of incomplete systems, complex processes, and inadequate quality monitoring in the recognition and conversion of learning outcomes at Guangdong Polytechnic of Science and Technology, suggestions are proposed to optimize management methods, standardize the process of recognition and conversion of learning outcomes, build an information platform for recognition and conversion of learning outcomes, and rely on vocational education groups to continuously standardize and orderly carry out recognition and conversion of learning outcomes.

Keywords: Learning outcomes; Credit recognition and conversion; Information platform; Course credits; Quality monitoring

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1. Introduction

In this new era, the world is in a wave of rapid change, with new situations and problems emerging one after another, and the updating and replacement of knowledge becoming increasingly rapid. To adapt to this ever-changing and constantly evolving objective world, individuals must transform learning from a single pursuit of knowledge to a deeply ingrained way of life and strive to achieve lifelong learning. Lifelong learning not only involves school education or specific training activities, but also encompasses various stages and forms of formal and informal learning in daily life. Lifelong learning has become a way for members of society to cope with changes in the external world and an uncertain future ^[1]. The Fourth Plenary Session of the 19th Central Committee of the Communist Party of China clearly pointed out the need to actively build an education system that serves lifelong learning for all, and ensure that everyone enjoys opportunities for lifelong learning, which has pointed out the future development direction for education reform in the new era. The “Modernization of

Education in China 2035” aims to establish a modern education system that serves lifelong learning for all citizens as its primary development goal. Realizing the connection and mutual recognition of different types of learning outcomes is not only an external incentive to promote lifelong learning for all, but also a key to completing this strategic task ^[2]. In the context of lifelong learning, the certification system for learning outcomes has become a bridge and channel connecting different types of education ^[3]. The Implementation Plan for National Vocational Education Reform released in 2019 provides support and guarantees for the recognition, accumulation, and transformation of learning outcomes from the policy and institutional levels ^[4]. At present, Guangdong, Jiangsu, Shandong, and other provinces have issued implementation opinions on credit recognition and conversion, encouraging universities within their provinces to actively explore mechanisms, standards, scope, processes, etc. for recognizing and converting learning outcomes. However, from the current theoretical and practical research, there are still problems such as inconsistent standards, incomplete mechanisms, narrow scope, and complex processes for identifying and converting learning outcomes.

This article takes Guangdong Polytechnic of Science and Technology as an example to carefully sort out and analyze the shortcomings in the recognition and conversion of learning outcomes: the system for recognition and conversion of learning outcomes is not sound, the recognition process is unclear, the recognition procedures are complex, and the quality monitoring is not in place. Targeted suggestions for recognition and conversion of learning outcomes are proposed, including optimizing the management methods for recognition and conversion, streamlining the process, building an information platform, and establishing a quality monitoring mechanism to help the school’s recognition and conversion of learning outcomes operate in an orderly and healthy manner.

2. Explanation of learning achievements

2.1. Learning outcomes

The concept of learning outcomes originated in 1979, when Eisner defined it as the result of participating in teaching activities in some form, a description of a learning state or learning performance, that is, “learning outcomes are the state that students ultimately achieve after participating in some form of activity” ^[5]. Mary Catharine Lennon, a PhD student at the University of Toronto, believes that clear learning outcomes are a clear statement of what learners know and can do at the end of a learning project, accompanied by appropriate assessment methods, which can provide a transparent way to understand students’ learning situations. It is a means of understanding, demonstrating, and evaluating the quality of education ^[6]. Global scholars have reached a basic consensus on the definition of learning outcomes, which refers to statements about what learners should know, understand, and be able to do after completing a learning process ^[7].

2.2. Types of learning outcomes

The content of learning outcomes is extensive and comes from various learning experiences of learners, including a certain level of knowledge, skills, and abilities acquired by students after participating in a specific series of school learning, as well as the results of all learning activities and various experiences that occur after learners enter society.

The first category is the academic learning outcomes in the formal education system. Formal education generally refers to school education, which is purposeful, planned, and organized education provided to students by specialized teaching personnel in fixed institutions or places. The learning outcomes are presented in the form of graduation certificates or credits.

The second type is non-degree training and learning outcomes in non-formal education systems. Non-formal

education refers to the collective term for educational and teaching activities conducted outside of organized educational institutions. It is usually a planned learning activity with clear learning objectives and targets, such as various job training, continuing education, etc. The learning outcomes are expressed through training certificates or qualification certificates.

The third type is the indefinite learning outcomes of the informal education system. Non-formal education is different from the two types of education mentioned above. It does not have specific learning time, learning objectives, or learning guidance, and is mostly a casual learning that accompanies learners' lives and work. The results of environments such as workplaces, libraries, and conversations are manifested in the form of experience, abilities, etc.

3. Current situation and existing problems of recognition and transformation of learning outcomes

3.1. Current situation of recognition and transformation of learning outcomes

Guangdong Polytechnic of Science and Technology (hereinafter referred to as "Gdit") has formulated the "Implementation Management Measures for Recognition and Conversion of Learning Achievements of Guangdong Polytechnic of Science and Technology," "Guangdong Lifelong Education Self Reliance Framework Level Standards," and "Overall Plan for Credit System Reform of Guangdong Polytechnic of Science and Technology" in accordance with the spirit of the "Implementation Opinions on Recognition and Conversion of Higher Education Credits of Guangdong Provincial Department of Education."

This management method consists of four chapters and 22 articles. Chapter 1, General Provisions, elaborates on the general requirements for the recognition and conversion of learning outcomes; for example, the courses for recognition and conversion of learning outcomes must be elective courses in the talent cultivation plan; Applicable to students enrolled in Guangzhou Academy of Sciences; The proportion of credits recognized and converted shall not exceed 50% of the total credits of the relevant major graduation; The course is the smallest unit for credit recognition and conversion, and can only be used for overall credit recognition at once. Chapter 2 provides a clear explanation of the scope, recognition, and conversion requirements for learning outcomes, including credit recognition and conversion requirements for eight types of learning outcomes: equivalent or higher education, lower-level education, higher education self-study examination courses, online courses, vocational qualification certificates, non-vocational qualification certificates, training certificates, and performance achievements. Chapter 3 explains the process of credit recognition and conversion: student application—initial review by the secondary college—review by the management department (academic affairs department)—public announcement—completion of credit recognition and conversion—credit counting by the teaching staff. Chapter 4 provides some supplementary explanations on credit recognition and conversion in the appendix.

3.2. Problems in the recognition and transformation of learning outcomes

Currently, the recognition and conversion of learning outcomes at Gdit has been carried out for many years, and it has been running smoothly and orderly. However, in the process of recognizing and transforming learning outcomes, some problems have also been found: the system for recognizing and transforming learning outcomes is incomplete, the process for recognizing and transforming learning outcomes is complex, and the quality monitoring of recognizing and transforming learning outcomes is not in place. These problems are not conducive to students' enthusiasm for obtaining and transforming learning outcomes, to meeting students' personalized and diversified learning needs, and to the integration and development of various academic and non-academic education, thus affecting the progress of

recognizing and transforming learning outcomes. Therefore, it is necessary to carefully sort out the shortcomings of school learning outcomes recognition and transformation work, and find practical and feasible solutions.

4. Thoughts on the recognition and conversion of learning achievements

In order to standardize and orderly carry out the recognition and conversion of learning achievements in Gdit, based on in-depth study of the “Implementation Plan for National Vocational Education Reform,” “Implementation Opinions of Guangdong Provincial Department of Education on Higher Education Credit Recognition and Conversion,” “Guangdong Lifelong Education Qualification Framework Level Standards,” and other documents, combined with the “Implementation Management Measures for Recognition and Conversion of Learning Achievements in Guangdong Polytechnic of Science and Technology” and the actual operation of school learning achievement recognition and conversion work, four suggestions are proposed.

4.1. Optimizing management methods, establishing organizational structure, and clarifying functional division of labor

Based on the actual situation of the recognition and conversion of learning achievements in the past work of Gdit, carefully sort out the “Implementation and Management Measures for Recognition and Conversion of Learning Achievements of Gdit” document, optimize the implementation and management measures for recognition and conversion of learning achievements, clarify the recognition and conversion standards, and effectively promote the standardized and orderly implementation of recognition and conversion of learning achievements. Firstly, establish a leadership organization for recognition and conversion of learning achievements, composed of school leaders in charge, the academic affairs department, the quality office, and other relevant personnel, to comprehensively lead and coordinate all aspects of recognition and conversion of learning achievements. Secondly, establish a structure for the recognition and conversion of learning outcomes, with the school’s academic affairs department responsible for promoting and publishing the recognition and conversion of learning outcomes, handling business, reviewing and certifying materials, and composed of professional experts, teaching management personnel, and frontline teaching staff. Again, establish a supervisory agency, with the school quality office responsible for supervising and inspecting the standardization and quality of the implementation of the recognition and transformation of learning outcomes.

4.2. Standardizing the process of recognizing and converting learning outcomes

The process of recognition and conversion of learning outcomes at Gdit is as follows: student application (academic system)—review by the secondary college—submission of review results to the academic affairs department—review by the academic affairs department—public announcement—submission of review materials to the teaching staff—credit counting. A standardized process is a key step in the recognition and conversion of learning outcomes. Therefore, firstly, it is necessary to provide strengthened training on the recognition and conversion standards (recognition standards, conversion standards) and processes for management personnel, frontline teachers, etc. involved in the recognition and conversion of learning outcomes, so that they are familiar with the standards and processes. Secondly, it is necessary to promote the standards and processes for recognizing and converting learning outcomes within the school, so that students know what kind of learning outcomes can be recognized and converted, how to recognize and convert learning outcomes, stimulate students’ interest in self-directed learning, personalized development, and lifelong learning, enhance students’ comprehensive literacy, and help the school develop with high quality.

4.3. Building an information platform for learning achievement recognition and conversion

The current process of recognition and conversion of learning outcomes at Gdit adopts a mixed online and offline recognition process. During the implementation of recognition and conversion of learning outcomes, it was found that the process is cumbersome and the recognition and conversion time is relatively long. In order to effectively implement the recognition and conversion of learning outcomes, the school promotes the use of “knowledge, skills, and abilities” as a universal currency to achieve substantial equivalence between learning outcomes and course credit conversion. Experts in various fields comprehensively examine the knowledge, skills, and abilities reflected in different types of learning outcomes within their respective fields. The course team decomposes and refines the course objectives in three dimensions: knowledge, skills, and abilities, and compiles specific measurable behavioral performance item by item. By comparative analysis, the course credits that can be converted from learning outcomes are obtained, achieving substantial equivalence. Develop a platform for “course score replacement and credit recognition,” establish a learning achievement library, credit recognition library, and course score library, store students’ learning achievements in the learning achievement library (personal lifelong learning file), apply for credit conversion of learning achievements on the platform, and after passing the review process, enter the score library, and then enter the learning achievement library to achieve course scores and credits recognized on the transcript display. In this way, on the one hand, it can make the recognition and conversion of learning outcomes more convenient, effective, and fair; on the other hand, the establishment of an information platform for the recognition and conversion of learning outcomes can make the information on learning outcomes recognition and conversion more transparent, facilitate supervision, and provide strong support for the development of learning outcomes recognition and conversion work.

4.4. Relying on Zhuhai Vocational Education Group to carry out standardized and orderly recognition and transformation of learning outcomes

Zhuhai Vocational Education Group is one of the first national demonstration vocational education group cultivation units, and Gdit is the chairman unit of the Vocational Education Group. Zhuhai Vocational Education Group is composed of three vocational colleges, namely Guangzhou Academy of Sciences, Zhuhai Vocational College of Arts, and Zhuhai City Vocational and Technical College, as well as multiple cooperative enterprises. The three vocational colleges within the group have cooperated to carry out multiple activities such as book resource sharing, three school student sports games, three school art festivals, and three school job fairs. On the basis of the recognition and conversion of learning achievements at Guangzhou Academy of Sciences, leveraging its advantages as the chairman unit of Zhuhai Vocational Education Group, Guangzhou Academy of Sciences conducts mutual selection of general education courses and recognition of differentiated course credits with vocational colleges such as Zhuhai City Vocational and Technical College within the group. It also collaborates with cooperative enterprises within the group to deeply recognize the learning achievements of students and enterprise employees through order classes, project classes, modern apprenticeship classes, and other forms. Connect the conversion channels between different types of academic education, academic and non-academic education, and on-campus and off-campus education to serve the economic development of Zhuhai and the Guangdong Hong Kong Macao Greater Bay Area.

5. Conclusion

The recognition and transformation of learning outcomes is an important research topic in the field of

vocational education. By comprehensively evaluating learners' learning outcomes, we can gain a more accurate understanding of their mastery of knowledge, skills, and abilities. Meanwhile, the conversion mechanism of learning outcomes helps to maximize the utilization of learning resources and promote the comprehensive development of learners. On the basis of in-depth analysis of the recognition and transformation of learning outcomes in the Gdit, this article proposes suggestions for carrying out the recognition and transformation of learning outcomes: optimizing management methods, clarifying functional division of labor; standardize the process of recognizing and converting learning outcomes; building an information platform; relying on the Vocational Education Group, we will continue to carry out standardized and orderly recognition and transformation of learning outcomes. In short, the implementation of recognition and transformation of learning outcomes is of great significance for improving the quality of education and promoting educational reform. In the future, the school will continue to deepen research on the standards, processes, and quality of recognition and conversion of learning outcomes, contributing to the construction of a more comprehensive system for recognition and conversion of learning outcomes.

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Disclosure statement

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A Study on the Educational Anxiety Experience of Chinese Rural Primary School Students' Mothers from the Perspective of Phenomenology

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Abstract: Parental educational anxiety has become a social symptom in China, and rural primary school students' mothers exhibit unique educational anxieties due to their special living environment. Based on interviews with 10 rural primary school students' mothers, five typical educational anxiety experiences were selected for analysis, and themes such as rural life burden, children's learning habits, mothers' educational expectations, mothers' educational methods, mothers' emotional state, deviation between reality and expectations, homework guidance ability, mothers' educational level, and attitudes towards children's future development were refined. The root causes of educational anxiety among rural primary school students' mothers include the deviation between children's actual performance and mothers' educational expectations, the sense of disparity under social comparison, physical and mental exhaustion caused by role overload, anxiety triggered by excessive economic burden, and a sense of powerlessness towards children's educational outcomes. To alleviate the educational anxiety of rural primary school students' mothers, mothers should actively adjust themselves, fathers should actively participate in their children's education, society should create a healthy atmosphere, and schools should strengthen family education guidance.

Keywords: Rural primary school; Mother; Primary school student; Educational anxiety; Phenomenological perspective

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1. Introduction

On May 31, 2021, the Political Bureau of the CPC Central Committee proposed the “policy allowing couples to have up to three children and related supportive measures.” This policy was introduced against the backdrop of declining birth rates in China following the implementation of the universal two-child policy. Public willingness to have children is reflected in two main attitudes: “not wanting to have children” and “wanting to have children but feeling unable to do so.” The top three reasons cited are heavy financial burdens, concerns about children's education, and difficulties for women in balancing family and work responsibilities. Educational anxiety is widespread among parents, particularly mothers, with mothers of rural primary school students exhibiting

unique manifestations of such anxiety due to their specific living conditions.

Through research on mothers of students at a central primary school in Q County, H Province, it becomes evident that rural mothers often feel helpless and frustrated when confronting their children's educational challenges. The second author of this paper, a former teacher at a rural school, observed that in many rural families, fathers typically work away from home, leaving mothers as the primary caregivers and communicators with the school. During repeated interactions, rural mothers displayed direct concern and love for their children. Their emotions were frequently tied to their children's academic performance and attitudes toward learning. Many mothers expressed feeling overwhelmed by their children's academic struggles, desiring change but feeling powerless. Over time, these feelings evolved into educational anxiety, which, under the influence of such maternal stress, could exacerbate children's rebellious or unruly behavior. Against this backdrop, critical questions arise: What forms does educational anxiety take among rural primary school mothers? What are its root causes? And how can such anxiety be alleviated? These issues warrant in-depth exploration.

2. Manifestations and analysis of educational anxiety among rural primary school mothers

Through interviews with 10 rural primary school mothers, their stories and feelings about their children's education were documented. Following phenomenological writing principles, five typical experiential narratives are presented below.

2.1. Manifestations of experiences

Experience 1: Dread of after-school hours

"My youngest child needs to be picked up from school every day. After finishing farm work, I rush to fetch him. When we get home, I start cooking, hoping he'll quietly do his homework. But the moment we arrive, he runs straight to the TV. No amount of coaxing works—only when I lose my temper does he reluctantly open his backpack. This happens almost daily. After scolding him, I still have to cook, wash dishes, and clean up. By the end of the day, I'm exhausted. He's only in fourth grade, but his homework is already overwhelming. Teaching him drains me completely. If it's this hard now, what about the future? The after-school hours are my most stressful time."

Experience 2: "Am I really a bad mom?"

"I'm raising my child alone while his father works away, returning only a few times a year. I handle all disciplines, big or small. To keep him in line, I often resort to yelling, which works—he obeys afterward. Boys are playful; he makes mistakes daily. If the teacher says he's unfocused in class, I scold him. If he drags his feet on homework, I scold him again. But once, I overheard him telling a friend: 'Mom is the meanest in the world! Dad's the best—he brings me snacks! Grandpa and Grandma give me pocket money too.' My heart sank. Am I really a bad mom?"

Experience 3: "Why are other kids so much better?"

"To earn more for my child's future, I work at an industrial zone an hour from home, clocking overtime daily. I'm only home on Sundays. My child stays with his grandparents, and I rely on the school's parents' chat online for updates. The teacher often shares exemplary homework or perfect test scores—but my child's name is never there. On weekends, neighbors chat about their kids excelling in town schools. Mine struggles even in a rural school. Why are others' children so outstanding? If he can't even study properly now, what will happen later?"

Experience 4: “Why is the pressure so crushing?”

“With society’s cutthroat competition, I pulled strings to transfer my child to a town school for better education. I rented a place nearby and took a low-paying supermarket job (1,200 yuan a month—just enough for rent). My husband’s income barely covers our expenses. I see online how vital ‘special talents’ are for kids, but supporting both elders and children is financially suffocating. Education can’t wait, but this grind is exhausting.”

Experience 5: Pandemic-era frustrations

“During the COVID lockdown, we had online classes at home. With three kids, we bought an extra phone and juggled devices. But instead of studying, they played games or watched TV. Homework was half-hearted—teachers couldn’t monitor everyone. Every day ended in fights. Is this even learning? Teachers can’t help, and I’m mentally exhausted. If they don’t study now, what future do they have?”

2.2. Analysis of experiences

To uncover the root causes of educational anxiety among rural mothers, a deep analysis of their lived experiences is essential. This study employs the reflective questioning method from phenomenological research to explore the underlying themes in each narrative (**Table 1**).

Table 1. Reflective questions, experiential analysis, and thematic summaries (example)

Reflective questions on experiences	Experiential analysis	Thematic summary
<i>“My child is young and needs to be picked up from school every day. After laboring in the fields, I rush to fetch them, return home to cook, and manage chores.”</i>	This reflects the harsh reality of rural mothers’ lives: juggling childcare, physically demanding farm work, and household responsibilities. Heavy daily burdens are a constant for rural mothers.	Rural life burden
<i>“I hoped my child would quietly do homework while I cooked, but they immediately turn on the TV. Only after I lose my temper do they reluctantly open their backpack. This happens daily.”</i>	The child’s behavior deviates from the mother’s expectations. It also highlights ineffective parenting methods: gentle persuasion (“coaxing”) fails, while anger (“losing temper”) becomes a last-resort tactic. The latter appears more effective short term.	Child’s study habits Maternal educational expectations Parenting methods Maternal emotional state Gap between reality and expectations
<i>“After scolding them, I still cook, clean, and wash dishes. By the end of the day, I just want peace, but the worst part is my child’s homework struggles. How will they manage in the future?”</i>	This reiterates the weight of rural life and the mother’s emotional exhaustion.	Rural life burden Maternal emotional state
<i>“My fourth-grader’s homework overwhelms me. Teaching them drains me. If it’s this hard now, what about later? After-school hours are my most stressful time.”</i>	The mother’s limited ability to assist with homework fuels anxiety. Complex assignments exceed her educational capacity, amplifying fears about her child’s future.	Mother’s educational level Homework assistance capacity Attitudes toward the child’s future

From the above analysis, key themes emerge: rural life burden, child’s study habits, maternal educational expectations, parenting methods, maternal emotional state, gap between reality and expectations, homework assistance capacity, mother’s educational level, and attitudes toward the child’s future.

Applying this method to all five experiences reveals that rural mothers’ educational anxiety stems primarily from: Heavy life burdens (farm work, childcare, household chores); Mismatch between children’s behavior and maternal expectations; Limited education hindering homework guidance; Role overload (acting

as both parents in father-absent households); Ineffective parenting strategies; Work-caregiving conflicts; Social comparisons (“other children’s success”); Deep-seated fears about their children’s prospects. Each of these dimensions will be analyzed in detail below.

3. Analysis of the root causes of educational anxiety among rural primary school mothers

Through thematic summarization, the underlying causes of educational anxiety among rural mothers have been clearly identified. This section explores the significance of such anxiety.

3.1. Anxiety stemming from unmet expectations

Interview data reveal that rural mothers generally face heavy life burdens, balancing physically demanding labor with childcare and educational responsibilities. To improve their circumstances, they expect their children to cherish opportunities and study diligently. However, children often fall short of these expectations. For instance, after school, children rarely start homework voluntarily but only complete tasks under repeated maternal pressure. During the pandemic, despite parents sacrificing resources to purchase devices for online learning, children often used phones for games rather than studying. This discrepancy between children’s actual behavior and maternal educational expectations fuels anxiety.

Rural mothers tend to hold excessively high educational expectations for their children. Like all parents, they hope their children will achieve success and escape rural hardships. Many mothers emphasized their own suffering due to limited education, which they attribute to their current struggles. They believe academic excellence is the most effective path for their children to become individuals with status and social standing. Consequently, rural parents place immense pressure on their children to excel academically. Yet, when children underperform or even rebel against these expectations, mothers experience profound disillusionment and anxiety.

3.2. Anxiety triggered by social comparisons

Rural primary school mothers frequently compare their children to “others’ kids.” In rural communities, where news spreads quickly, discussions about children’s academic performance dominate daily conversations. Through these exchanges, mothers gain precise insights into the academic progress of their children’s peers in their village. Armed with this information, they inevitably measure their own children against others. When their child underperforms academically or acts rebelliously, maternal anxiety intensifies. As the saying goes, “Comparing people kills joy”—rooted in social comparison theory, individuals often define themselves through comparisons with others. Rural mothers evaluate their children by contrasting them with classmates or neighbors’ kids.

For instance, mothers who entrust childcare to grandparents while working away from home grow deeply anxious when their child is never praised in class group chats. Similarly, conversations with neighbors about their children excelling in town schools—compared to their own child’s mediocre rural school performance—spark profound fears about their child’s future. These examples underscore how maternal anxiety is magnified by relentless social comparisons.

3.3. Anxiety from role overload

Analysis of lived experiences reveals that rural mothers commonly grapple with the dual pressures of “supporting the elderly while raising the young” and heavy financial burdens. Influenced by traditional norms, childcare and

education are largely viewed as maternal responsibilities. The adage “men work outside, women manage the household” entrenches this division of labor: fathers often migrate for work to sustain the family economically, while mothers remain home to care for children, elders, and household duties. A survey of 50 students at Q Town Central Primary School found that fathers in most families rarely engage in their children’s education.

Rural mothers juggle laundry, cooking, farm labor, and educational tasks like homework supervision, facing immense daily pressures. By the time children return home, mothers are already exhausted from the day’s labor. Confronting children’s academic struggles in this state amplifies their anxiety. The compounded roles of “caregiver for both old and young” and “acting as both parents” create overwhelming role overload, leaving mothers emotionally strained.

3.4. Anxiety stemming from economic burdens

At present, China’s compulsory education resources remain unevenly distributed, with urban areas offering significantly higher-quality resources compared to rural regions. To secure better education for their children, rural families strive to enroll them in superior schools ^[1]. A minority of financially capable rural parents opt for urban private schools, but most cannot afford the tuition and fees, instead choosing county-level schools. Sending children to county schools exacerbates the financial burden on rural households. Parents must either commute to urban areas for school drop-offs/pickups or rent housing to accompany their children during schooling. If accompanying children during schooling is chosen, this responsibility typically falls on mothers. For rural families, accompanying children during schooling not only increases transportation and housing costs but also reduces household income by removing one laborer. The combination of rising educational expenses and declining earnings heightens maternal anxiety.

3.5. Anxiety stemming from educational ineffectiveness

Interviews reveal that rural primary school mothers generally have low educational attainment, with most having only completed middle school. Due to their limited education, their parenting philosophies tend to be outdated, their methods traditional, and their capacity to guide their children’s studies constrained.

3.5.1. Anxiety from outdated educational beliefs

Many rural mothers believe that strict discipline alone ensures academic success. When children misbehave, they resort to scolding or physical punishment, creating adversarial dynamics. Unaware of the broader influences on learning—such as family atmosphere, parent-child relationships, societal norms, and parental behavior—they oversimplify education. One mother stated, “*If teachers are strict at school and I’m strict at home, my child will study.*” This narrow perspective overlooks holistic factors. For instance, when children resist studying, mothers intensify lectures, triggering emotional clashes that backfire. While didactic approaches dominate, the lack of nuanced techniques stifles children’s enthusiasm for learning. Mothers grow anxious as their rigid methods fail to yield desired outcomes.

3.5.2. Anxiety from limited capacity to assist with homework

Most rural mothers struggle academically, making homework guidance arduous. While they manage lower-grade subjects, higher-grade coursework overwhelms them. As children advance, maternal stress escalates, compounded by exhaustion and helplessness. The inability to support their children’s academic growth deepens their anxiety.

3.5.3. Anxiety from ineffective parenting strategies

Rural mothers frequently rely on anger, harsh reprimands, or scolding to enforce compliance. Though such methods may produce short-term obedience, they fail to address root causes and harm long-term parent-child relationships. Constant confrontations leave mothers in prolonged emotional agitation, detrimental to their well-being. Furthermore, doubts about the sustainability of these stopgap measures—coupled with guilt over their harshness—fuel cycles of anxiety.

4. Strategies to alleviate educational anxiety among rural primary school mothers

Based on the analysis of root causes, this study proposes multi-stakeholder interventions—involving mothers themselves, fathers, society, and schools—to mitigate educational anxiety among rural mothers.

4.1. Mothers should actively adjust their perspectives

First, set reasonable educational expectations. Rural mothers often view education as the sole path to upward mobility, leading to excessively high expectations. The greater the expectations, the higher the investment and fear of failure, intensifying anxiety. Overly ambitious goals can overwhelm children, producing counterproductive outcomes. Thus, mothers should adopt a developmental perspective, recognizing that academic performance is not the sole measure of a child's worth. They must learn to identify and nurture their children's strengths beyond grades.

Second, shift educational philosophies. Rural mothers prioritize academic achievement and study habits, often neglecting other aspects of their children's growth. Many act as controllers, demanding compliance with rigid developmental scripts. Excessive focus on grades and comparisons to “others' children” fuels anxiety. Mothers should broaden their outlook, acknowledging that holistic development—not just test scores—defines a child's potential.

Third, manage emotions constructively. Many rural mothers fixate on educational responsibilities, becoming trapped in cycles of anxiety. Beyond childcare, they should cultivate personal interests to counterbalance stress. Engaging in recreational activities—such as community gatherings or hobbies—can provide emotional outlets and reduce anxiety.

4.2. Fathers should engage in educational responsibilities

Under traditional norms, rural mothers often view childcare and education as solely their duty—a misconception. A child's education is a shared parental responsibility. Surveys reveal that many rural fathers disengage from their children's education, leaving mothers overburdened with household chores, farm labor, and academic oversight. Active paternal involvement can alleviate maternal stress. A father's authoritative role itself is a vital educational resource; moderate participation yields better outcomes. Fathers' engagement acts not only as a support mechanism but also as an antidote to maternal anxiety ^[2].

4.3. Society should foster a healthy educational climate

Education extends beyond families and schools—it shapes societal talent pools. Rural education is a critical frontier, and maternal anxiety impacts both mothers and children's development. Society must acknowledge its educational role and cultivate constructive norms.

First, governments must intervene. Public institutions should guide and support rural education through policy and funding. Increased fiscal allocations for rural schools, improved public educational infrastructure, and enriched learning environments are essential ^[3].

Second, the media must disseminate positive messaging. Rural mothers heavily rely on mobile phones for entertainment, making them susceptible to online narratives. Media should promote progressive educational values—emphasizing child-centered, holistic development—to counter outdated ideologies^[4].

Third, reform societal discourse. Prevailing narratives prioritize exam-oriented education, with advertisements and platforms often exacerbating parental competition. Shifting public discourse toward celebrating diverse talents can reduce mothers’ fixation on grades and alleviate anxiety.

4.4. Schools should strengthen parental guidance

As the primary educational hub, schools significantly influence parental attitudes. Current school-home communication often reinforces stress (e.g., “Study hard or return to farming”). To counter this:

First, reaffirm educational essence by implementing the “Double Reduction” policy. Excessive academic competition has distorted schooling. The policy’s focus on reducing homework and tutoring burdens helps families rediscover education’s true purpose—nurturing well-rounded individuals—and eases maternal anxiety.

Second, adopt holistic student evaluations. Schools traditionally prioritize grades, but modern society demands moral, intellectual, physical, aesthetic, and labor development. Multidimensional assessments (e.g., creativity, collaboration) should replace narrow metrics, conveying balanced feedback to families^[5].

Third, provide scientific parenting guidance. Most rural mothers lack modern educational knowledge. As experts, teachers must bridge this gap through parent workshops, sharing evidence-based strategies for communication, discipline, and emotional support. Empowering mothers with skills to engage their children constructively—rather than through coercion—can transform anxiety into confidence.

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Career Self-Management and Career Success among Junior Middle School Art Teachers in Shenzhen, China

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Abstract: Under the background of exam-oriented education in China, art education has been marginalized, and the career success of junior middle school art teachers is being challenged. The influencing factors have become a topic worthy of exploration. Therefore, this study aims to investigate the influence on career success and career self-development among junior middle school art teachers in Shenzhen, China. This study conducted a questionnaire survey among junior middle school art teachers in Shenzhen, China. The results show that career self-management affects the career success of art teachers. On this basis, this study proposes some strategies to help the group of art teachers achieve higher career success by improving their career self-management levels.

Keywords: Career success; Career self-management; Junior middle school art teachers; Shenzhen; China

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1. Introduction

For a long time, the field of art education has been regarded as the most vulnerable component of the entire education system in China. Due to the long-term emphasis on “exam-oriented education,” there is no need for a special examination for art in junior middle school, and the status of art teachers is lower than that of their counterparts in other academic fields, thus marginalizing them in their work ^[1]. As time goes by, a considerable number of junior middle school art teachers have begun to express dissatisfaction with their career paths ^[2]. They doubt their career choice and professional identity, which eventually leads to job burnout ^[1]. Meanwhile, the art education of junior middle school is classified as non-professional art education, which leads to limited professional applicability and reduced professional sense of achievement for junior middle school art teachers ^[1]. Shi ^[3] observed that the recognition and importance of middle school art teachers by society do not match the huge work pressure they face, and their emotional management is often neglected. This negligence leads to job burnout and low career self-management and career commitment, which has an adverse impact on their career

success. This phenomenon has aroused the interest of the academic circle in the investigation of the professional situation of art teachers in China.

Therefore, it is appropriate to examine the challenges faced by the disadvantaged group of art teachers in China from the perspective of “what constitutes the career success of art teachers.” Given that the early surveys of junior middle school art teachers mainly focused on three aspects: teaching practice ^[4], quality and ability, and professional development ^[5], these key issues have yet to be resolved at present. Therefore, the purpose of this study is to investigate the influencing factors of the career success of junior middle school art teachers, aiming to expand the existing knowledge framework and have a profound understanding of the current situation of junior middle school art teachers. Therefore, this study aims to explore the influence of career self-management of junior middle school art teachers in Shenzhen on career success.

2. Literature review and research hypothesis

2.1. Career success of junior middle school art teachers in Shenzhen, China

When studying the concept of career success in the academic field, we assume that career success is intrinsically linked to both salary and personal satisfaction, as these factors are important indicators of the academic career trajectory. In the context of the success of the teaching profession, various factors can usually be observed, including self-satisfaction, overall life satisfaction, self-esteem, commitment to the profession, and leadership support, all of which play a key role ^[6]. This phenomenon occurs because educators have a subjective tendency towards career success, and they mainly regard this success as a form of self-satisfaction. Those who work within the framework of idealism may demonstrate a higher intrinsic motivation to achieve career success ^[7]. Teachers often view the field of education as an idealistic pursuit. Therefore, when their values are verified through significant experiences, the realization of their career success becomes obvious.

However, the teaching training for junior middle school art teachers lacks professionalization in art education, mainly aiming to disseminate basic art knowledge to students and cultivate their art appreciation ability. Therefore, the professional relevance and achievements of junior middle school art teachers have still been greatly reduced. Meanwhile, art teachers have become a marginalized group in the education system and have experienced long-term neglect in their professional roles ^[8]. Through Fan’s investigation of local art teachers, the author believes that a key factor for the decline in the status of art teachers is the increasing pressure exerted by higher education on students, which forces many schools to shift their course time to subjects that require assessment, although they offer art courses.

For a long time, this has contributed to a widespread misunderstanding that art courses can be regarded as optional, filled in indiscriminately, and terminated at will, which has greatly reduced the enthusiasm of art teachers in the classroom, and many people have chosen to pursue other career paths. This phenomenon indicates the influence of academic viewpoints on the professional effectiveness of teachers. When art teachers experience the depletion of both internal and external incentives, they inevitably face challenges related to career success. Essentially, the current situation of art education in junior middle schools in China may, to a large extent, lead to an increase in the turnover rate of art teachers, a decrease in career commitment, and limited self-management, thereby adversely affecting their career success.

2.2. Career self-management and career success

Career success has been a subject of debate, with some confusing it with career achievement. Research defines career success as both objective and subjective outcomes stemming from an individual’s work experience ^[9].

Objective career success is externally evaluated by third parties, measured through job status, income, and promotion. Subjective career success, conversely, is an individual's internal assessment, often gauged by job and life satisfaction. It is related to variables such as career commitment, career satisfaction, career decision (all subjective), and career growth opportunities (objective) (career-invested individuals tend to experience greater subjective and objective success).

Greenhaus *et al.* ^[10] defined career self-management as “the process by which individuals develop, implement, and monitor” ^[9,11,12]. In the study by Hirsch and Koen ^[13], they also adopted this definition. In the social-cognitive model of career self-management, Lent and Brown ^[14] focused on “adaptive occupational behavior,” which they defined as “the behaviors people use to help guide their career (and educational) development.” In fact, Wang and Wanberg ^[15] argued that career self-management should be viewed as an umbrella term that includes the various cognitive and behavioral activities that shape an individual's career development and career transition, and determine how an individual handles expected and unexpected career events, challenges, and career transitions.

According to the existing literature, career success can be divided into two dimensions: subjective career success and objective career success. Based on this, researchers delved deeply into the relationship between career self-management and subjective career success as well as objective career success, and found that career self-management is mainly related to subjective career success. Shepard ^[16] once proposed that individuals would follow the “path of the mind” throughout their careers to achieve success at the psychological level. King ^[17] held that through the long-term and effective application of professional self-management behaviors, individuals can complete their career development tasks and achieve the expected career outcomes. Quigley and Tymon ^[18] further proposed that when career self-management stems from intrinsic career motivation, that is, essentially from career meaning, choice, ability, and progress, successful career self-management will lead to subjective career success, and this hypothesis was verified in their research.

Furthermore, in the field of the teaching profession, the importance of professional self-management is equally significant. Derakhshan *et al.* ^[19] emphasized that continuous professional development (CPD) and teachers' perception of research are important components of career success. Teachers who actively engage in professional development and research activities are more likely to achieve a higher sense of professional accomplishment, highlighting the significance of professional self-management and lifelong learning for teachers' career development and outcomes.

Therefore, this research proposes the following hypotheses:

H1: Career self-management positively and significantly influences career success intra-organizational competitiveness (CSIOC).

H2: Career self-management positively and significantly influences career success extra-organizational competitiveness (CSEOC).

H3: Career self-management positively and significantly influences career success job satisfaction (CSJS).

3. Methods

3.1. Research design

This study adopted a quantitative research design method to conduct a questionnaire survey among junior middle school art teachers in Shenzhen, China in order to measure the relationship between career success and career self-management of participants. In terms of career success, this study adopted the career success scale translated, compiled, and developed by Wang and Long. This scale adopts the 7-Likert scale, ranging from 1 to

7 (strongly disagree to strongly agree), and includes three dimensions of career success: career success intra-organizational competitiveness (CSIOC), career success extra-organizational competitiveness (CSEOC), and career success job satisfaction (CSJS). Verified by relevant studies on this scale, its reliability and validity are acceptable, manifested as their Cronbach's α coefficients being 0.739 (CSIOC), 0.753 (CSEOC), and 0.85 (CSJS), respectively.

The career self-management scale is derived from the revision and translation of the research results of Noe ^[20], Zikic and Klehe ^[21] by Weng ^[22]. This scale adopts the 5-Likert scale, ranging from 1 to 5 (strongly disagree to strongly agree). This scale also has good reliability and validity, which is reflected in the fact that the questionnaire includes three dimensions, namely career exploration, career goal setting, and career strategies. The internal consistency coefficient of career exploration is 0.86, the internal consistency coefficient of career goal setting is 0.83, and the internal consistency coefficient of career strategies is 0.78. However, researchers have shown that the comprehensive measurement of career self-management (including all three dimensions) has a stronger predictive validity for career outcomes than any single dimension. For instance, De Vos *et al.* ^[23] analyzed career self-management as a general dimension in their research. Therefore, this study also analyzes career self-management from an overall perspective, hoping to comprehensively capture career self-management behaviors and their impact on career outcomes.

3.2. Data analysis

There was a total of 263 valid data in this study. The SPSS 29.0 statistical software tool was used to conduct descriptive statistical analysis on the 263 observed data (**Table 1**). Besides, for using SPSS 29.0, this research is part of the research on career success among junior middle art teachers in Shenzhen, China.

In this study, the gender distribution of the respondents clearly shows a tendency that the proportion of females is higher. Among the 263 respondents, 175 were female, accounting for 66.50% of the total sample. Male respondents accounted for 33.50%, totaling 88 people. Meanwhile, the age distribution of the respondents shows a characteristic dominated by young people, especially those aged 25 to 35. Furthermore, in terms of the educational background of the respondents, 66.2% of them have a bachelor's degree, indicating that the overall educational attainment of the sample is relatively high.

Table 1. Descriptive statistics ($n = 263$)

Dimension	Min	Max	Mean	SD	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	SE	Statistic	SE
CSIOC	1.00	7.00	5.011	1.317	-0.487	0.150	-0.163	0.299
CSEOC	1.00	7.00	5.148	1.133	-0.581	0.150	0.933	0.299
CSJS	1.00	7.00	4.565	1.333	0.049	0.150	-0.597	0.299
CSM	1.09	5.00	3.720	0.600	-0.045	0.150	1.322	0.299

Through descriptive analysis, the mean dimension of CSIOC is 5.011, the standard deviation is 1.317, the skewness is negative, and the kurtosis is close to normal. The mean value of the CSEOC variable is 5.148, and the standard deviation is 1.133, indicating moderate negative skewness and positive kurtosis. The mean value of CSJS is 4.565 with a standard deviation of 1.333. The data shows that the kurtosis is negative and the skewness is almost zero. Meanwhile, the mean value of CSM is 3.720, and the standard deviation is 0.600, indicating that the skewness is the smallest and the kurtosis is high.

To test the significance level, in this study, the bootstrapping function of SmartPLS 4.0 was used to generate the *t*-statistics of all paths to test the three research hypotheses^[24]. Hair *et al.*^[25] found that an estimated path coefficient close to +1 indicates a strong positive correlation. The closer this value is to 0, the weaker this relationship becomes. **Table 2** shows the evaluation of the structural model of the research hypothesis. It can be seen from the table that the value range of the path coefficient is between 0.278 to 0.404.

Table 2. Structural model assessment for direct relationship

Hypothesis	Path	Beta	SE	<i>t</i>	<i>P</i>	5.00%	95.00%
H1	CSM -> CSIOC	0.278	0.088	3.171	0.001	0.141	0.429
H2	CSM -> CSEOC	0.404	0.087	4.630	0.000	0.260	0.548
H3	CSM -> CSJS	0.336	0.074	4.544	0.000	0.218	0.461

The results also show that CSM has a positive effect on CSIOC ($\beta = 0.278$, $P = 0.001$), CSEOC ($\beta = 0.404$, $P = 0.000$), and CSJS ($\beta = 0.336$, $P = 0.000$). Because the assumed *t* values are all greater than 1.645. Furthermore, the columns Upper Limit (UL) and Lower Limit (LL) in the table represent the 95% confidence intervals of the beta coefficient, which do not contain zero value; hence, H1, H2, and H3 are supported.

4. Findings and discussions

This study investigated the influence of career self-management on the career success of junior middle school art teachers in Shenzhen, filling the gap in this research field. Furthermore, this study has discovered strong evidence to support the three proposed research hypotheses. That is, career self-management has a significant positive impact on the career success intra-organizational competitiveness, career success extra-organizational competitiveness, and career success job satisfaction of junior middle school art teachers in Shenzhen.

Firstly, the mean values of CSIOC, CSEOC, and CSJS indicate that the perception of their own competitiveness and job satisfaction among junior middle school art teachers in Shenzhen, China, is generally positive, but there is still room for improvement. The mean value of career self-management indicates that the overall level of teachers' career self-management is at a medium level, and there is potential to further improve this aspect to further enhance career success.

Among the three dimensions of career success, career self-management has the greatest impact on career success extra-organizational competitiveness, followed by job satisfaction, and then career success intra-organizational competitiveness. This means that art teachers can gain more external recognition and personal career satisfaction through effective career self-management.

The research results simultaneously confirm the positive and significant impact of career self-management on all dimensions of career success. This indicates that art teachers who engage in more career self-management activities are more likely to enhance their competitiveness within schools or educational institutions. They may actively seek opportunities for professional development, participate in internal competitions or activities, and thereby gain recognition and better positions within the organization.

For career success extra-organizational competitiveness, the research finds that career self-management is closely related to teachers' ability to stand out outside their direct workplace. Teachers who manage their careers well can build professional networks, participate in external art-related activities, or obtain additional certificates, all of which can help enhance their external competitiveness.

Career self-management also has a significant positive impact on career success job satisfaction. When art teachers play an active role in managing their careers, they are more likely to find meaning and a sense of achievement in their work. This might be because they can better combine their work with their personal career goals, thereby obtaining a more satisfactory work experience.

5. Implications and recommendations

However, it is important to pay attention to the background in which these findings are situated. Junior middle school art teachers in China are facing many challenges. The long-term emphasis on “exam-oriented education” has marginalized art education and art teachers. The lack of professionalization in the training of art teachers has further exacerbated this problem and reduced the professional relevance and achievements of art teachers. Despite these challenges, the positive relationship between career self-management and career success indicates that an individual’s efforts in career self-management can still have a substantial impact.

Therefore, based on the above findings, this study puts forward some suggestions. For example, colleges and universities should recognize the importance of promoting art teachers’ career self-management. They can offer resources like career counseling, goal-setting, and network strategy workshops, and access to professional development opportunities to enhance art teachers’ competitiveness and the quality of art education. For policymakers, they should focus on factors affecting art teachers’ career success. Since career self-management can offset some negative impacts of the educational environment, policies should be made to encourage and support art teachers’ self-management efforts, such as providing incentives for professional development and recognition programs.

Based on these findings, further research should explore the mediating factors or antecedents that affect the career success and career self-management of art teachers and study potential solutions. Furthermore, in future research, it is also possible to consider including respondents from different regions of China to expand the scope of the research population, enhance the universality and representativeness of the research results, and increase the power of statistics.

Disclosure statement

The authors declare no conflict of interest.

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The Impact of an AI-Empowered Blended Teaching Model on Chinese EFL Students: A Case Study of Superstar Learning Platform

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Abstract: While artificial intelligence (AI) shows promise in education, its real-world effectiveness in specific settings like blended English as a Foreign Language (EFL) learning needs closer examination. This study investigated the impact of a blended teaching model incorporating AI tools on the Superstar Learning Platform for Chinese university EFL students. Using a mixed-methods approach, 60 first-year students were randomized into an experimental group (using the AI-enhanced model) and a control group (traditional instruction) for 16 weeks. Data included test scores, learning behaviors (duration, task completion), satisfaction surveys, and interviews. Results showed the experimental group significantly outperformed the control group on post-tests and achieved larger learning gains. These students also demonstrated greater engagement through longer study times and higher task completion rates, and reported significantly higher satisfaction. Interviews confirmed these findings, with students attributing benefits to the model's personalized guidance, structured content presentation (knowledge graphs), immediate responses, flexibility, and varied interaction methods. However, limitations were noted, including areas where the platform's AI could be improved (e.g., for assessing speaking/translation) and ongoing challenges with student self-discipline. The study concludes that this AI-enhanced blended model significantly improved student performance, engagement, and satisfaction in this EFL context. The findings offer practical insights for educators and platform developers, suggesting AI integration holds significant potential while highlighting areas for refinement.

Keywords: AI-empowered blended learning; EFL education; Personalized learning; Learning outcomes; Superstar Learning Platform

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1. Introduction

Artificial intelligence (AI) is increasingly reshaping education globally. This trend highlights the academic community's growing belief in AI's potential to transform teaching methods and improve educational outcomes^[1]. Around the world, educational policies and initiatives increasingly emphasize the integration of technologies

like AI to enhance learning experiences ^[2]. This policy emphasis translates into increased exploration and implementation of technology-enhanced teaching models, notably blended learning ^[3]. A key motivation for adopting these approaches is the belief that they can encourage more active, autonomous, and personalized learning for students ^[4].

The Superstar Learning Platform, a widely adopted smart learning system in Chinese higher education, introduced significant AI capabilities around 2024, including its AI Teaching Assistant, Knowledge Graph, and various AI Tools ^[5]. The Superstar platform incorporates several key AI components to support both teaching and learning activities. The AI Teaching Assistant provides interactive functionalities for both teachers (content management, voice commands) and students (intelligent Q&A, information search, application invocation). A central feature is the Knowledge Graph system, which involves dedicated tools and manuals for constructing and utilizing structured representations of course content. Furthermore, the platform offers a wide array of AI Tools, accessible through an AI Workbench, designed to assist with specific tasks. This set of tools assists with various tasks, including content creation, facilitating student interaction, assessment, learning analytics, and course management.

Despite the increasing adoption and potential advantages of blended teaching models using AI, their practical effectiveness is not yet well understood. Specifically, more empirical evidence is needed on how these models impact student learning outcomes, shape their learning behaviors, and affect their overall learning experiences. Furthermore, as Esakkiammal and Kasturi ^[6] highlighted, “many artificial intelligence models employ generalized datasets, which might not adequately reflect the many learning environments and student population.” Addressing these research gaps is therefore essential.

Therefore, this study introduced and tested a blended teaching model incorporating AI features on the Superstar Learning Platform. The primary goal was to examine how effectively this model could enhance personalized learning for Chinese EFL students. The study focuses on the following research questions:

- (1) How does the AI-empowered blended teaching model influence students’ learning outcomes, behaviors, and experiences in tertiary EFL education?
- (2) What limitations exist in the practical application of the AI-empowered blended teaching model, and how can its functionalities be optimized to better support teaching practices?

2. Literature review

Blended learning (BL), integrating face-to-face instruction with online learning environments, is a well-established pedagogical approach ^[7,8]. Within English as a Foreign Language (EFL) education, particularly in contexts like China, BL has seen significant adoption and study. Research demonstrates its potential to create efficient learning environments, enhance learner autonomy, and increase satisfaction ^[9], with specific implementations showing significant improvements in listening and speaking skills compared to traditional methods ^[10] and yielding higher post-test scores alongside positive student perceptions ^[11]. Models utilizing frameworks like the Community of Inquiry have also shown success in improving multiliteracies ^[12]. While generally effective, successful BL implementation faces persistent challenges, including integrating components seamlessly, ensuring adequate technical support, adapting pedagogy, and providing sufficient teacher training ^[13,14].

Building upon established BL models, the integration of AI represents a significant technological evolution, enhancing the online dimension. AI applications in BL often focus on asynchronous individual learning, where they can serve as mediators for student autonomy or supplementary assistants, leveraging

advanced learning analytics^[3]. AI's core strength lies in analyzing learner data using techniques like machine learning^[15] to enable unprecedented levels of personalization and adaptive feedback^[16]. In the L2/EFL context, this translates into tools powered by natural language processing (NLP), such as automated writing evaluation (AWE) systems^[17] and conversational agents, although learner factors remain important^[18]. The goal is often to create individualized learning paths responsive to progress^[19,20].

This AI-driven personalization resonates with learners^[21], and emerging evidence indicates substantial potential benefits. For instance, studies show AI-driven personalized paths and gamification in blended settings significantly improve language acquisition, citing increases such as 25% in vocabulary learning and 30% in reading comprehension^[22]. However, deploying these powerful tools introduces critical considerations. Significant ethical concerns around algorithmic bias^[23] and data privacy^[24] demand attention. Furthermore, successful implementation requires supportive measures, including management backing, enhanced training, reliable infrastructure, and improved internet connectivity^[25], alongside thoughtful pedagogical integration aligned with language teaching principles^[19] and adequate teacher support^[26]. As AI technology advances, particularly generative AI, further research will be crucial to guide effective implementation.

Therefore, while BL provides a robust and demonstrably effective framework in the Chinese EFL context, and AI offers powerful tools for enhancement like personalization, their combined implementation requires careful scrutiny. There is a need for specific investigations into how integrated AI-enhanced BL models function in practice within particular educational contexts, considering potential benefits, student experiences, and inherent challenges. This study addresses this need by examining the impact of one such model, implemented via the Superstar Learning Platform, on the learning experiences and outcomes of Chinese EFL students.

3. Methods

3.1. Participants

The participants in this study were 60 first-year undergraduate students majoring in Clinical Medicine (Class of 2024) at Wenzhou Medical University, China. These students demonstrated a similar level of English proficiency upon entering university, with scores ranging from 120–135 on the National College Entrance Examination (*Gaokao*) English test and 65–75 (out of 100) on their university English placement test. All participants were new to university-level English (EFL) courses and had no prior experience with similar blended learning models. Participants were randomly assigned to either an experimental group ($n = 30$) or a control group ($n = 30$). Each group maintained a gender ratio of 8:7 (16 males, 14 females).

3.2. Research design

This study employed a mixed-methods research design, combining experimental research with interviews, to comprehensively evaluate the effectiveness of a university English blended learning model facilitated by the Superstar Learning Platform. Both the experimental and control groups used the New College English (4th Edition) textbook. Instruction comprised four 40-minute class sessions per week over a 16-week period.

3.2.1. Experimental group intervention

The experimental group participated in four weekly class sessions: one online session and three face-to-face sessions. The online session utilized the Superstar Learning Platform for completing preparatory assignments and personalized learning activities. Face-to-face sessions focused on instructor guidance and classroom interaction. The instructional process included:

- (1) Pre-class: Instructors uploaded teaching materials (e.g., presentations, videos, exercises) and defined learning objectives on the Superstar Learning Platform. Students used the platform to complete assigned preparatory tasks, while an AI Teaching Assistant (AI TA), drawing on individual student progress and performance, offered personalized resource recommendations to enhance preparation efficiency.
- (2) In-class: Instruction integrated teacher explanations with AI TA support, which included various interactions facilitated by AI tools. During text analysis, instructors used the AI platform to pose interactive questions. Students could respond instantly or share opinions using a real-time commenting feature (barrage). The AI TA offered immediate feedback on responses and generated data reports for instructor review. Instructors also utilized the AI TA's group discussion function to facilitate small group discussions on text themes, with the AI TA recording contributions and providing real-time language suggestions.
- (3) Post-class: A personalized learning support system combined tasks assigned by both the AI TA and instructors. Based on student performance data, the AI TA automatically generated customized review materials and practice exercises, complete with detailed answer keys and learning advice. Instructors used AI TA-provided learning analytics to monitor student progress, identify areas needing reinforcement, assign targeted supplementary tasks, and dynamically adjust future teaching focus.

3.2.2. Control group intervention

The control group also attended four weekly class sessions, all conducted face-to-face using traditional teaching methods. Instruction covered grammar, vocabulary, reading, and listening skills, primarily through lectures, with students generally in a passive role of receiving information. The instructional process included:

- (1) Pre-class: Instructors prepared lesson plans based on the syllabus and textbook, detailing learning objectives, key concepts, anticipated difficulties, and planned activities. Students completed assigned preparatory tasks independently, without the use of any AI tools.
- (2) In-class: Classroom activities were predominantly instructor-led, following the textbook sequence. Instructors delivered explanations on grammar, vocabulary, and reading strategies using presentations or the blackboard, supplemented with examples. They guided students through analyzing the structure and language features of reading and listening materials. Limited in-class practice exercises were assigned for individual completion, followed by instructor explanations and Q&A sessions. Interaction primarily involved teacher-posed questions and student responses, with an emphasis on knowledge transmission and content coverage.
- (3) Post-class: Students completed homework assigned by the instructor, typically consisting of textbook exercises or writing tasks. Instructors manually graded these assignments, providing detailed written feedback on errors. Common issues identified in the homework were addressed collectively during subsequent class meetings.

In essence, the experimental group's design integrated AI TA capabilities with traditional instruction to foster personalized support and diverse interactions. In contrast, the control group adhered to a conventional pedagogical approach centered on knowledge dissemination and comprehensive content coverage. Comparing these two instructional approaches allows this study to assess the specific impact of the blended learning model incorporating AI on student learning outcomes, behaviors, and overall experience.

3.2.3. Interview design

To gain deeper insights into the specific effects of the AI-empowered blended learning model on learning outcomes, behaviors, and experiences, as well as to gather feedback on potential weaknesses and suggestions for improvement, semi-structured interviews were conducted after the 16-week intervention. Participants included two university English instructors involved in teaching the experimental group and 10 students from the experimental group. The selected students had learning duration, task completion rates, and post-test scores that closely approximated the averages for the entire experimental group, ensuring the representativeness of the interview sample. Interview questions were structured into two main areas: (1) Learning outcomes, behaviors, and experiences, and (2) Model limitations and optimization suggestions, with 3–4 questions tailored for instructor and student perspectives within each area.

3.3. Data collection and analysis

3.3.1. Test scores

Both pre- and post-tests were administered using the Foreign Language Teaching and Research Press (FLTRP) iTest platform question bank, each with a maximum score of 100 points. The pre-test assessed baseline language proficiency (grammar, vocabulary, listening, and reading). The post-test, comprising exercises related to the course textbook, evaluated improvements in learning outcomes following the instructional period. Descriptive statistics and independent samples *t*-tests were employed to analyze differences in test scores between the experimental and control groups.

3.3.2. Learning duration and task completion rate

Data were gathered throughout the experimental period. For the experimental group, learning duration and task completion rates were automatically logged by the Superstar Learning Platform. For the control group, learning duration was compiled from student self-reported records of time spent on homework, while task completion rates were manually tracked by the instructors.

3.3.3. Questionnaire survey

A questionnaire was developed drawing upon Astin's Student Involvement Theory, the Technology Acceptance Model (TAM), and established instruments like the Student Learning Experience Questionnaire (SLEQ), adapted for the study's specific context. The instrument exhibited good content validity and reliability (Cronbach's $\alpha = 0.87$)^[27–29]. The survey gathered student perspectives on the teaching model's effectiveness and their learning experiences, measuring constructs including learning interest, satisfaction with resources, classroom participation, perceived learning support, and overall satisfaction.

3.3.4. Interview data

Interviews were audio-recorded and transcribed verbatim. The textual data were analyzed using thematic analysis. Key ideas and viewpoints were extracted and coded, then organized into themes reflecting the core research questions (i.e., application effectiveness, learning behaviors and experiences, model shortcomings, and optimization suggestions). Within each theme, primary perspectives from both instructors and students were summarized, highlighting illustrative examples and concrete recommendations to ensure the findings were representative and logically structured.

4. Results

This section presents the findings from the quantitative (test scores, learning behaviors, satisfaction survey) and qualitative (interviews) data analyses comparing the blended learning group with AI support (experimental) and the traditional teaching group (control).

4.1. Comparative analysis of student learning outcomes

4.1.1. Descriptive statistics

Based on **Tables 1** and **2**, the pre-test mean scores for the experimental and control groups were 69.67 (SD = 3.527) and 69.37 (SD = 3.000), respectively. This indicates that the initial proficiency levels of the two groups were comparable, indicating that the groups were comparable at the outset. Post-test mean scores showed the experimental group (M = 82.53) performed significantly better than the control group (M = 72.57). Furthermore, the mean gain for the experimental group (12.86 points) was substantially greater than that of the control group (3.20 points). Additionally, both the minimum (80) and maximum (85) post-test scores in the experimental group exceeded those in the control group (Min = 70, Max = 75), suggesting widespread improvement within the experimental group.

Table 1. Experimental group pre- and post-test descriptive statistics

	<i>n</i>	Min	Max	Mean	Standard deviation
Pre-test score	30	65	75	69.67	3.527
Post-test score	30	80	85	82.53	1.833

Table 2. Control group pre- and post-test descriptive statistics

	<i>n</i>	Min	Max	Mean	Standard deviation
Pre-test score	30	65	75	69.37	3.000
Post-test score	30	70	75	72.57	1.716

4.1.2. Paired samples *t*-test

As shown in **Tables 3** and **4**, the mean difference between pre- and post-test scores for the experimental group was 12.867, $t(29) = 17.050$, $P < 0.001$, indicating a highly statistically significant improvement in scores. For the control group, the mean difference was 3.200, $t(29) = 4.969$, $P < 0.001$. While both groups showed statistically significant improvement, the magnitude of the gain was substantially smaller in the control group compared to the experimental group.

Table 3. Experimental group pre- and post-test paired samples *t*-test

		Mean difference	SD	SE mean	95% CI lower	95% CI upper	<i>t</i>	<i>df</i>	Significance (2-tailed)
Exp.	Post-test - Pre-test	12.867	4.133	0.755	11.323	14.410	17.050	29	0.000

Table 4. Control group pre- and post-test paired samples *t*-test

		Mean difference	SD	SE mean	95% CI lower	95% CI upper	<i>t</i>	<i>df</i>	Significance (2-tailed)
Ctrl.	Post-test - Pre-test	3.200	3.527	0.644	1.883	4.517	4.969	29	0.000

4.1.3. Post-test scores and independent samples *t*-test

An independent samples *t*-test was conducted to compare the post-test scores between the two groups (Table 5). The results indicated that the experimental group's mean post-test score ($M = 82.53$, $SD = 1.833$) was significantly higher than the control group's ($M = 72.57$, $SD = 1.716$), $t(58) = 21.741$, $P < 0.001$. The relatively small standard deviations in both groups suggest that scores were clustered closely around their respective means, suggesting a consistent performance gap favoring the experimental group.

Table 5. Group statistics for post-test scores

	Group	<i>n</i>	Mean	Standard deviation	Standard error mean
Post-test score	Exp.	30	82.53	1.833	0.335
	Ctrl.	30	72.57	1.716	0.313

4.2. Comparative analysis of student learning behaviors

Independent samples *t*-tests revealed significant differences in learning behaviors between the groups (Table 6). The average learning duration for the experimental group ($M = 30.27$, $SD = 1.721$) was significantly higher than the control group's ($M = 22.27$, $SD = 1.639$), $t(58) = 18.441$, $P < 0.001$. Similarly, the average task completion rate for the experimental group ($M = 92.17$, $SD = 1.724$) was significantly higher than the control group's ($M = 82.63$, $SD = 1.866$), $t(58) = 20.556$, $P < 0.001$. The data distributions for both groups were relatively concentrated (indicated by small standard deviations), with the experimental group demonstrating higher learning engagement in terms of both time spent and tasks completed.

Table 6. Descriptive statistics for learning duration and task completion rate

	Group	<i>n</i>	Mean	Standard deviation	Standard error mean
Learning duration (hours)	Exp.	30	30.27	1.721	0.299
	Ctrl.	30	22.27	1.639	0.314
Task completion rate (%)	Exp.	30	92.17	1.724	0.315
	Ctrl.	30	82.63	1.866	0.341

4.3. Comparative analysis of student learning experiences

An independent samples *t*-test compared student satisfaction scores, measured via questionnaire, between the groups (Table 7). The results showed that the mean satisfaction score for the experimental group ($M = 4.43$, $SD = 0.504$) was significantly higher than that of the control group ($M = 3.47$, $SD = 0.507$), $t(58) = 7.403$, $P < 0.001$. This indicates greater student satisfaction with the AI-enhanced blended teaching model. The similar standard deviations and small standard errors suggest relatively consistent satisfaction levels within each group and precise mean estimates.

Table 7. Group statistics for student satisfaction

	Group	<i>n</i>	Mean	Standard deviation	Standard error mean
Satisfaction	Exp.	30	4.43	0.504	0.092
	Ctrl.	30	3.47	0.507	0.093

4.4. Analysis of interview results

Semi-structured interviews with 10 students (S1 to S10) and two instructors (T1 and T2) from the experimental group provided qualitative insights into the model's impact and areas for improvement.

4.4.1. Impact of the AI-empowered blended teaching model on student learning outcomes, behaviors, and experiences

Interviewees linked improved learning outcomes to the model's precise feedback and personalized support. The knowledge graph was frequently cited as helpful for grasping concepts efficiently, particularly in writing, reading, and grammar. S1 stated, *"The AI feedback highlights the types of grammatical errors in my essays, provides explanatory examples, and pushes relevant practice exercises, which have been very effective for my error correction."* S2 noted, *"The skill points structured in the knowledge graph are very useful. When I encounter a difficult sentence during translation, I check the knowledge graph and can easily find relevant information."* Teachers valued the data-driven insights: T1 explained, *"The AI generates learning reports for each student. This clearly shows me common problems across the class, requiring pedagogical adjustments, as well as individual difficulties where targeted help is needed."*

In terms of learning behaviors, instant feedback and reminders were seen as key drivers for improved self-management. S3 commented, *"Right after finishing exercises, I know immediately what I got wrong...so I can revisit that point for consolidation."* S4 found the reminders helpful: *"The platform regularly reminds me to complete assignments...otherwise, I easily forget."* Teachers observed increased motivation and participation, particularly through diverse interaction methods. T2 remarked, *"Some students are shy... However, they are very active using the platform's real-time commenting feature (barrage), and I can sense their learning engagement has increased."*

Concerning the learning experience, flexibility and personalized interaction were highly valued. S5 appreciated the control over learning pace: *"The traditional classroom has a fixed learning pace, but with the online component, I can control my own time and progress. This is especially helpful when I have scheduling conflicts with school activities, allowing me to flexibly arrange my studies."* S6 contrasted the richer interactions with previous experiences: *"Previously...peer interaction was quite monotonous...But the Superstar Learning Platform offers many interaction methods, like barrage comments and gamified quizzes, which are fun..."*

4.4.2. Limitations of the AI-empowered blended teaching model and suggestions for optimization

Limitations primarily involved platform functionality and AI capabilities. Students desired features currently unavailable, such as real-time AI feedback for speaking (S7: *"The platform lacks the real-time AI feedback for speaking practice...forcing me to use other applications."*) and automated grading for translation (S8: *"Translation feedback...relies on the teacher grading it...less efficient than getting direct feedback..."*). The AI TA's recommendations were sometimes perceived as lacking precision or prioritization (S9: *"The AI TA pushes many learning tasks, sometimes all at once...priority sorting...would be much better."*).

Teachers noted challenges with student self-discipline (T1: *"Despite repeated reminders, some students still fail to complete assignments on time..."*). Both students and teachers felt the platform's AI, while helpful, was "less intelligent" than contemporary generative AI tools like ChatGPT, particularly in the nuance of its recommendations.

An interpersonal concern was also raised (S3: *"With the AI TA, I feel the distance between me and the teacher has increased..."*). Teachers acknowledged the potential additional workload for managing less self-

directed students offline (T1: “*For students with weaker self-discipline...I still need to find extra time offline to talk with them.*”).

Key optimization suggestions derived from the interviews include:

- (1) Implementing learning checklists and progress visualization tools.
- (2) Developing mock testing functions for international exams.
- (3) Creating intelligent assessment tools for speaking and translation with real-time feedback.

5. Discussion

This study investigated the impact of an AI-enhanced blended teaching model, facilitated by the Superstar Learning Platform, on the learning outcomes, behaviors, and experiences of Chinese university EFL students. The findings provide empirical support for the model’s effectiveness while also highlighting areas needing refinement.

5.1. Interpretation of findings in relation to existing literature

The significantly higher post-test scores achieved by the experimental group align with previous research demonstrating the effectiveness of blended learning in EFL contexts ^[9,11]. The substantial learning gain observed suggests an added benefit from integrating AI. Specifically, the qualitative data suggest that the AI TA’s personalized feedback and resource recommendations, particularly through features like the knowledge graph and targeted exercises (as described by S1 and S2), were key contributors. This aligns with the theoretical view that AI can deliver personalized learning paths and adaptive feedback, as highlighted in the literature ^[16,19,20]. The observed improvements resonate with studies like Wu *et al.* ^[22], which reported significant gains in language acquisition through AI-driven personalized approaches in blended settings.

The increased learning duration and task completion rates in the experimental group indicate higher learning engagement, consistent with Astin’s ^[27] Student Involvement Theory, which posits that greater involvement leads to better outcomes. The AI features, such as instant feedback (S3) and automated reminders (S4), likely fostered greater self-regulation and sustained effort, supporting the idea that AI can act as a mediator for student autonomy in blended environments ^[30]. The enhanced classroom participation noted by T2, facilitated by features like barrage commenting, suggests the model also improves social presence, a key component of effective online and blended learning within frameworks like the Community of Inquiry ^[8].

The significantly higher satisfaction scores in the experimental group suggest a positive reception of this particular teaching model. This aligns with the Technology Acceptance Model (TAM), where perceived usefulness (effectiveness in learning, personalized support) and perceived ease of use (flexibility, engaging interactions described by S5 and S6) likely contributed to positive attitudes and acceptance ^[28]. The finding also echoes Le Quang’s ^[21] observation that AI-driven personalization resonates positively with learners.

5.2. Limitations of the implemented model and optimization needs

Despite the overall positive results, the interviews revealed specific limitations with the Superstar Learning Platform’s current AI capabilities, reflecting broader challenges in AI educational tool development. The lack of sophisticated AI feedback for productive skills like speaking and translation (S7, S8) points to ongoing challenges in developing robust NLP capabilities for complex language assessment ^[17]. The perception that the AI was “less intelligent” than commercial generative AI highlights the rapid pace of AI technology and user expectations; educational platforms may struggle to keep pace with cutting-edge developments.

The persistent issue of student self-discipline (T1) reinforces that technology alone cannot overcome fundamental challenges in learner motivation and time management, a known difficulty in less structured blended learning environments ^[13,14]. Furthermore, the student's comment about increased distance from the teacher (S3) and the teacher's note on additional workload (T1) highlight the critical need to balance technological integration with human interaction and adequate support systems. This echoes concerns about maintaining social presence ^[8] and the necessity of teacher training and support for successful technology implementation ^[25,26].

5.3. Implications

The findings offer several practical and theoretical implications. For practitioners (educators and institutions), this study provides evidence that AI-supported blended learning like that implemented here can significantly benefit EFL learning, particularly through personalization and enhanced engagement. However, successful implementation requires careful consideration of platform features, student self-regulation support, and maintaining a strong teacher presence. The optimization suggestions (learning checklists, progress visualization, mock tests, enhanced AI assessment for speaking/translation) provide concrete directions for improving practice. For platform developers (like Chaoxing), the feedback highlights the need to enhance AI capabilities, particularly for productive skills, refine recommendation algorithms, and integrate features that support student planning and self-monitoring. Incorporating more advanced generative AI features while addressing ethical concerns ^[23,24] could also improve user experience.

Theoretically, the study reinforces the applicability of frameworks like TAM and Student Involvement Theory in understanding student responses to AI-enhanced learning environments. It also reveals a complex interplay between the AI features used (personalization, feedback), student behaviors (engagement, self-regulation), and their learning experiences (satisfaction, interaction, teacher connection) within a specific blended learning context.

5.4. Limitations of the study

This study has several limitations. First, the sample size was relatively small ($n = 60$) and drawn from a specific context (first-year clinical medicine majors at one Chinese university), which may limit the generalizability of the findings. Second, the 16-week duration may not be sufficient to capture the long-term effects of the model. Third, the study focused on the Superstar Learning Platform; results might differ with other platforms possessing different AI capabilities. Fourth, while efforts were made to ensure group comparability, subtle pre-existing differences could have influenced outcomes. Finally, the control group's learning duration relied on self-report, which may be less accurate than the platform-logged data for the experimental group.

5.5. Suggestions for future research

Future research should address these limitations. Larger-scale studies involving diverse student populations (different majors, proficiency levels, universities) are needed to validate the model's effectiveness more broadly. Longitudinal studies could track the long-term impact on learning habits, skills development, and student motivation. Comparative studies evaluating different AI platforms or specific AI features (e.g., comparing different types of feedback mechanisms) would also be valuable. Research exploring pedagogical strategies to enhance student self-discipline within AI-integrated blended learning settings is crucial. Finally, investigating the integration and impact of advanced generative AI tools within educational platforms represents a significant

and timely area for future inquiry.

6. Conclusion

This study investigated the effectiveness of an AI-empowered blended teaching model implemented via the Superstar Learning Platform within a Chinese university EFL context. By employing a mixed-methods approach, the research demonstrated that compared to traditional instruction, this model significantly enhanced students' academic performance (test scores), learning engagement (duration and task completion), and overall satisfaction. Qualitative data attributed these benefits primarily to the AI's capacity for personalized feedback, resource recommendation, flexible scheduling, and diverse interaction modes.

Despite these advantages, the study also identified functional limitations of the current platform, challenges related to student self-discipline, and the ongoing need to balance technological tools with human pedagogical guidance and connection. The findings provide valuable empirical evidence supporting the potential of AI to innovate EFL teaching practices within blended learning frameworks, while also offering concrete suggestions for optimizing such models. This research contributes to the understanding of AI's role in education and offers practical insights for educators, institutions, and technology developers striving to create more effective and engaging learning experiences in the digital age.

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Research on the Current Situation of Incorporating Folk Songs into Kindergarten Education Activities from the Perspective of Intangible Cultural Heritage Transmission

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Abstract: Children's rhymes, as a kind of folk language culture that accompanies children's growth, carry rich regional cultural connotations and play a crucial role in early education as an important form of enlightenment. With their concise and elegant sentence structures and unique rhymes, they are like lively musical notes flowing in children's innocent hearts, thus being hailed as "the songs flowing in children's hearts"^[1]. Due to their unique artistic value, children's rhymes have been included in the category of intangible cultural heritage. The organic combination of intangible cultural dialects, folk wisdom, and children's rhymes education has injected new vitality into the dynamic inheritance of culture and has become a vivid practice of the current educational model of teaching children through entertainment. Through humorous and lively content and diverse interactive forms, children's rhymes not only cultivate children's aesthetic ability and musical literacy but also enhance their language ability and strengthen their sense of belonging to local culture in an imperceptible way. However, with the acceleration of urbanization and the wide spread of Mandarin, intangible cultural dialect children's rhymes are facing a severe crisis of decline. Based on this real situation, from the perspective of protection and inheritance, this paper deeply studies the current situation of intangible cultural dialect children's rhymes in kindergarten education activities, explores innovative paths, and aims to provide new ideas and methods for maintaining their cultural vitality.

Keywords: Cultural heritage inheritance; Children's rhymes; Kindergarten education

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1. Introduction

1.1. Research background

To strengthen the protection and inheritance of China's intangible cultural heritage, the state has successively issued policy documents such as "Opinions on Implementing the Project of Inheriting and Developing Fine

Traditional Chinese Culture” and “The ‘14th Five-Year Plan’ for the Protection of Intangible Cultural Heritage,” emphasizing the importance of the protection of intangible cultural heritage and proposing specific goals and tasks for its inheritance and development. Kindergartens, as important venues for children’s early education, shoulder an irreplaceable and significant mission in cultural inheritance. The “Trial Guidelines for Kindergarten Education” clearly states: “Make full use of social resources to guide children to actually experience the richness and excellence of the culture of our motherland, feel the changes and development of our hometown, and stimulate children’s love for our hometown and our motherland.” The “Guidelines for Learning and Development of Children Aged 3–6” emphasizes that “Let children come into contact with excellent literary works, enabling them to feel the richness and beauty of language, and help children deepen their experience and understanding of the works through various activities.” These educational policies and concepts provide clear guidance for kindergartens to carry out intangible cultural heritage education. Taking Fuzhou nursery rhymes as an example, in kindergarten teaching, Fuzhou dialect nursery rhymes are organically combined with teaching content, creating a music environment that is familiar and friendly to children, allowing children to accept dialect nursery rhymes in their familiar and beloved nursery rhyme songs ^[2], among which “Civilization Tour” and “Luk Er La Mei” were selected as excellent nursery rhymes.

1.2. Practical cases of nursery rhyme education activities carried out in kindergartens

From the perspective of inheriting intangible cultural heritage (ICH), the multi-dimensional exploration of integrating children’s rhymes into kindergarten education activities reveals that the ICH cultural inheritance model based on dialect as the carrier and children’s rhymes as the medium can effectively achieve the deep integration of excellent traditional culture and early childhood education. It has been practiced in many provinces and cities. For instance, Huangshan Kindergarten in Lijiang City incorporated Naxi ethnic language children’s rhymes into its own curriculum. Through weekly special courses and the “relay” teaching model, children can feel the charm of ICH in the melodious dialect rhythm. At the same time, a transmission chain of “school–family–society” was constructed ^[3]. For example, Wisdom Tree Kindergarten in Linxiang City and Boya Kindergarten in Xinhui District created and performed children’s rhymes in Cantonese and Linxiang dialects, which not only retained language characteristics but also stimulated children’s interest in local culture ^[4]. The dynamic inheritance of such ICH children’s rhymes has sown cultural seeds in children’s hearts through innovative curriculum design and teaching methods, strengthening the dual functions of cultural identity and language inheritance and injecting new vitality into it. The book *Selected Traditional Children’s Rhymes of Fujian* edited by Wang Meitian includes 156 traditional children’s rhymes from places such as Fuzhou, Xiamen, Quanzhou, Longyan, and Zhangzhou ^[5]; *Goddess Songs of Tulou* compiled by He Zhixi includes 24 Hakka children’s rhymes ^[6].

2. Problems existing in the current integration of intangible cultural heritage children’s rhymes into kindergarten education activities

2.1. Double alienation in the selection of activity content

Firstly, in the process of integrating intangible cultural heritage children’s rhymes into kindergarten education, the tendency of one-sided content selection and “de-localization” during the adaptation process is particularly prominent. Many kindergartens focus excessively on children’s rhymes with strong entertainment value when choosing them. However, rhymes such as those about labor and dialects, which are relatively complex and require teachers to possess solid historical and cultural knowledge as well as proficient teaching skills, are rarely adopted

in kindergarten education. Secondly, when adapting ICH children's rhymes, some teachers, in order to facilitate children's understanding and singing, overly "de-dialectize" during the adaptation process. When all dialects in the rhymes are replaced with Mandarin, although the language becomes more accessible and easier to understand, it reduces the difficulty for children to comprehend and loses the original regional characteristics and cultural charm.

2.2. Monotonous teaching implementation methods

During the implementation of teaching, the teaching methods adopted by kindergarten teachers are rather monotonous. The survey data shows that most teachers only use the collective recitation method to carry out nursery rhyme teaching activities. This single teaching method lacks game-based and context-based design, resulting in boring and uninteresting teaching activities that fail to attract children's attention and have a generally low level of participation from children. In collective recitation, teachers usually lead children to read nursery rhymes sentence by sentence, paying too much attention to the pronunciation and rhythm of the language, while neglecting the cultivation of children's interests and active participation. Although this method can cultivate children's language expression ability and rhythm sense to some extent, and enable children to initially experience the beauty of the rhymes' rhythm, due to the lack of innovation and interest, it is difficult to fully mobilize children's enthusiasm and initiative.

2.3. Teachers' lack of ability to deeply explore resources

At present, some teachers have obvious shortcomings in the aspect of cultural exploration, which seriously restricts the effective implementation of education on intangible cultural heritage folk songs. In the actual teaching process, they merely stop at the shallow level of having children memorize the words and sentences, completely neglecting the in-depth analysis of the rich cultural connotations, such as social life, folk customs, and traditional values contained in the folk songs. As a result, the function of inheriting regional culture is weakened, and the cultural value of intangible cultural heritage folk songs is greatly discounted. From the perspective of teaching skills, teachers often limit themselves to the traditional mode of explanation and demonstration, and their teaching methods lack innovation and diversity. They also fail to effectively integrate community and family resources to expand teaching scenarios, thereby providing more powerful support and assistance for the education of intangible cultural heritage dialect folk songs.

2.4. Lack of nursery rhyme environments in kindergartens

Kindergartens have exposed obvious deficiencies in the environmental creation for the education of intangible cultural heritage dialect nursery rhymes. The proportion of kindergartens that have specially set up intangible cultural heritage corners is relatively low, which reflects that most kindergartens do not attach sufficient importance to the display and inheritance of intangible cultural heritage. In fact, setting up an intangible cultural heritage corner is an important way to effectively integrate intangible cultural heritage elements into kindergarten education, and it has extremely important and specific value in indoor environmental creation^[7]. This not only fails to attract the attention of children in a timely manner but also fails to meet children's desire for exploration of new knowledge. Eventually, children's interest in it gradually fades, and the important role of intangible cultural heritage corners in education and teaching cannot be fully exerted.

2.5. Lack of collaborative mechanisms among families, schools, and communities

The participation and support of parents towards the education of intangible cultural heritage provided by

kindergartens and communities show a polarized trend. Families with high educational attainment usually fully recognize the significance of ICH nursery rhymes for children's growth and actively participate in it. On the contrary, for left-behind children's families, due to the long-term absence of parents from home for work, grandparents have cognitive limitations and lack sufficient understanding and attention to ICH nursery rhyme education. The lack of a collaborative mechanism between kindergartens and communities prevents both parties from effectively integrating community ICH resources, making it difficult to form a powerful educational synergy and thus unable to provide more opportunities for children to come into contact with and understand dialects.

3. Strategies for improving the integration of intangible cultural heritage nursery rhymes into kindergarten education activities

3.1. Construction of the curriculum system

3.1.1. Building the framework of the “three-dimensional goals”

In the dimension of cultural cognition, a dialect voice library (including eight Min dialect variants) was set up, and symbol decoding games were designed to help young children recognize and understand different dialects. In the dimension of emotional identification, “Grandparent-Grandchild Singing Together” activities are carried out to strengthen cultural memory through intergenerational communication and enhance children's emotional identification with local culture. In terms of behavioral formation, design intangible cultural heritage practice passports to record children's experiences of participating in traditional festivals and cultivate their awareness and behavior of inheriting intangible cultural heritage in practice. Taking the “Kneading Rice Balls Together” course at Fuzhou Children's School as an example.

3.1.2. Building a scientific curriculum system

The construction of a curriculum system is the core to effectively integrate nursery rhymes into the educational activities of kindergartens. When selecting course content, fully consider the age characteristics and cognitive levels of children, and choose representative, interesting, and educational nursery rhymes. For example, in the small class, simple, vivid, and rhythmic nursery rhymes such as “Little Star” and “Little Rabbit Be Good” can be chosen to help children initially perceive the beauty of language rhythm and rhyme; in the middle and large classes, nursery rhymes with richer content and certain cultural connotations, such as “Three-Character Classic” and “Disciple's Rules,” can be selected to guide children to deeply understand excellent traditional culture and cultivate good moral and behavioral habits in the process of learning nursery rhymes.

3.2. Innovation in teaching methods

3.2.1. Innovating traditional teaching models

Firstly, teachers can design a rhyming game with a gamified learning approach, breaking down the content of the rhymes into multiple levels. In the game, children start by reciting a rhyme accurately and fluently, then move on to rhyme-related knowledge quizzes, and finally perform the actions of the rhymes. Secondly, teachers can create a “Non-heritage Market” scenario, setting up various stalls in the classroom to simulate the buying and selling of non-heritage items. In the “Non-heritage Market,” children can sing rhymes related to buying and selling while conducting transactions. Through this contextualized teaching method, children can more vividly experience the atmosphere of non-heritage culture, and at the same time improve their language expression and social skills.

3.2.2. Empowering the teaching process with science and technology

Teachers can make use of AR technology to create children's rhyme cards under certain conditions. By scanning multi-modal children's rhyme cards, one can trigger 3D scenes, dialect voice libraries, and animated stories. For instance, they can design augmented reality games such as "Children's Rhymes Monopoly." They can also construct a knowledge map of regional culture by integrating children's rhymes with geographical, historical, and folk customs data. They can also design teaching aids like "Children's Rhymes Magic Box." Firstly, it is equipped with dialect voice chips, which can trigger original ecological singing, allowing young children to listen to the most genuine interpretation of children's rhymes. Secondly, it sets up AR scene cards, and by scanning them, historical scenes can be presented, enabling young children to feel as if they have traveled through time and experienced the background of the era depicted in the children's rhymes, effectively improving the accuracy rate of young children's correct understanding of related knowledge.

3.3. Optimizing teacher training and integrating social resources

3.3.1. Optimizing the teacher training system

By establishing a hierarchical training system, we aim to enhance teachers' cultural inheritance literacy in a targeted manner. For novice teachers, systematic basic theoretical training on intangible cultural heritage children's rhymes is conducted. Through special lectures (inviting ICH experts to interpret the inheritance context) and online courses (providing teachers with the opportunity to independently study the cultural analysis module), a complete knowledge map is constructed. The focus is on strengthening the cultivation of teaching basic abilities, such as the pronunciation rules of dialects and the interpretation of folk customs imagery. For teachers with certain teaching experience, the "practice-research" double helix training model is implemented. Teachers are also encouraged to participate in ICH field investigations, and together, a "children's rhymes cultural gene bank" is established to enhance teachers' ability to interpret cultural connotations and transform them into teaching content.

3.3.2. Integrating all kinds of social resources

Kindergartens can form joint teams with traditional intangible cultural heritage (TICH) inheritors and folklorists, have teachers participate in the practice of TICH bases, complete the entire process training of "collecting-organizing-teaching transformation" for "children's rhymes," implement the "master-apprentice system" for mentoring and guidance, and regularly carry out on-the-job learning and teaching discussions. Kindergartens can also collaborate with universities and communities to offer TICH experience courses, jointly create a "children's rhymes inheritance workshop," and set up three functional areas: dialect theater (inviting folk artists to perform on-site), folkloric laboratory (equipping with interactive devices for children's rhymes related to festivals), and children's rhymes story sessions (analyzing the background of TICH). At the same time, kindergartens can also reach out for cooperation with museums and cultural centers, making them the central database for children's rhymes in reality, and launching the series of activities "Children's Rhymes in Museums."

3.4. Improving the mechanism of cooperation and co-education between home and kindergarten

Establishing a communication platform for home-kindergarten interaction enables the timely sharing of

information regarding nursery rhyme education activities. Parents can witness scenes of children learning nursery rhymes in class, the wonderful moments of participating in nursery rhyme performances, as well as their progress and growth achieved during the activities. Parents can also share their experiences and insights on the platform, promoting communication and cooperation among parents. Kindergartens can invite parents to participate in the development of course resources, such as “Little Fatboy Wearing a Mask” created by parents of Taijiang Experimental Kindergarten, integrating epidemic prevention knowledge into the Fuzhou rhyme pattern: “Little Fatboy Wearing a Mask, The Virus Will Run Away Quickly.” The home-kindergarten cooperation and co-education mechanism is an important guarantee for integrating nursery rhymes into kindergarten education activities. It can integrate educational resources from both families and kindergartens, forming educational synergy, and jointly promoting the inheritance and development of intangible cultural heritage nursery rhymes in early childhood education.

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TikTok for Pop Vocal Music Education: The Guideline and Practical Cases

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Abstract: With the development of new media technology and the popularity of the TikTok platform in China, a large number of popular vocal music teachers have flocked to online platforms for teaching. Online vocal music education in China is undergoing a transformation and facing challenges. This study adopts an exploratory research approach, interviewing students learning pop vocal music, and observing popular pop teachers on TikTok. The advantages, disadvantages, techniques, and methods of domestic TikTok pop vocal music teaching were investigated and studied, and a series of experiences and suggestions for optimizing TikTok teaching were put forward. The results of this study are helpful for understanding the advantages and disadvantages of TikTok pop vocal music teaching and grasping the correct development direction. These guidance and suggestions can stimulate teachers' creativity and improve their vocal music teaching level.

Keywords: Online education; Pop vocal; TikTok; Music teaching

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1. Introduction

Under the guidance of the strategic development policy of Internet +, all walks of life have been invested in the wave of innovation and development, and the education industry is no exception. The biggest advantage of the Internet is that people can constantly deepen and improve themselves by making full use of the development background of Internet +. People can enjoy the unlimited information resources provided by it in any place. This feature also makes the vocal music teaching mode from the origin of circulation to each region, so that colleagues who love vocal music can learn better vocal music teaching.

In particular, 2020 was a very difficult year for traditional offline vocal music teaching. Due to the sudden outbreak of the epidemic, some teachers, either actively or passively, found themselves in front of the camera, initiating live-streamed education via the Internet. This shift has brought both opportunities and challenges to vocal music teaching. Vocal music teachers must rise to the occasion and strive to integrate online and offline modes, finding a balance between virtual instruction and real-life interaction. To maximize the benefits of both

approaches, short video broadcasting platforms have emerged as alternative models to traditional teaching methods. However, these platforms also come with certain limitations that cannot be overlooked. Both teachers and students must critically assess the constraints of online vocal music learning. How can these limitations be addressed, and how can effective teaching be achieved in this new environment?

TikTok teaching has become a trend, but there are few articles about using TikTok for vocal music teaching. Therefore, based on the case of online vocal music teaching on the TikTok platform and through interviews with relevant personnel, this paper deeply analyzes the unique advantages and existing problems of vocal music teaching on the TikTok short video platform under the background of new media. It also shares a series of experiences and suggestions for optimizing TikTok teaching. The results of this study will provide talents in the field of vocal music teaching that can keep up with the pace of the times, make full use of network technology to optimize the traditional teaching mode, and improve teaching efficiency.

2. A new way to learn vocal music: Short video online platform

From the literature review, studying music teaching and learning via social platforms is quite popular in China. For example, Lei ^[1] found that online music art education is a beneficial supplement to traditional music art education. As the country gradually attaches importance to online art education and social capital continues to invest in it, online art education has a good prospect of development. Through the long-term efforts of art educators, online music art education in China can flourish. Lei believed that online music education is an art education platform for the whole society, especially for non-professional ordinary people ^[1]. Online music education is one of the important ways to improve people's cultural literacy. More and more non-professionals are learning about music online. Compared with traditional music education, online music education costs less time and money. TikTok is a good platform to integrate capital. It can provide a good way for online music education to develop. We can see that there are many types of online music education, from the initial resource website to the later live teaching, and so on; there are many different paths. Xu ^[2] divided online music education into two categories: (1) One-way resources: This kind of online music education has been established for a long time and enjoys a certain reputation. However, it is mainly based on resource sharing, most of which are free, and some of which are charged, like MOOCs; (2) Two-way interactive: Compared with the early resources output online music learning, online one-to-many or one-to-one two-way music courses have gradually become a trend. TikTok, a short video social live streaming platform, falls into this category ^[2]. Such platforms attract corresponding customer groups through certain marketing means and provide teaching services in the form of free live streaming or group purchase of courses. This kind of live broadcasting platform has powerful functions of asking questions and leaving comments in real time. Besides completing the teaching content, teachers can also further explain and answer questions according to the needs of students, which greatly improves the degree of interaction.

According to Li's research ^[3], the number of Internet users in China is 940 million, and the number of online video users (including short videos) is 888 million. From the continuous growth of short video users, it can be seen that Internet short video platforms have high user penetration, strong user stickiness, and obvious year-on-year growth. Internet short video platform users are highly active. In many popular short video platforms such as TikTok, a music teaching account not only has millions of fans, but also has hundreds of millions of video views. Li believed that music teaching resources on short video platforms are rich and easy to obtain. Through the short video platform, users can easily search and obtain music teaching

resources. Users also have greater autonomy in choosing learning content, and can compare and freely select homogeneous content ^[3]. From the point of view of Lv ^[4], teaching content can be organized freely, which is conducive to the play of music teachers' subjective initiative. With the continuous upgrading of mobile devices such as smartphones, the recording of music teaching content is more convenient, and users can independently organize teaching content, style characteristics, and lecture duration. Moreover, the communication effect of short video music teaching is obvious. Not only is the number of users large, but also the activity is high, and the communication effect is strong. Featured music teaching resources can gather similar "circle layer" users in a short time, and realize the dynamic balance between music content suppliers and music content demanders ^[4].

The TikTok platform offers a new approach to vocal music teaching. Among the vocal music teachers interviewed, all of them have over two years of experience in teaching pop vocal music on the TikTok platform. With the question "Why do teachers choose the TikTok platform for teaching?", they replied that they generally believe that TikTok has a large number of users and is the most used short-video social platform in China, which ensures a source of students. Secondly, the TikTok platform has powerful functions, which can both broadcast live and release short videos. It makes teaching quick and easy. Indeed, the TikTok platform has made vocal teaching and learning easier. During the author's undergraduate studies, pop vocal singing was studied, which often led to reflections on various questions related to singing. When questions arose or hesitation occurred, in addition to consulting the teacher, answers were also sought on TikTok. For example, if the rage technique was to be learned or improvisation techniques were to be explored, a relevant question could be typed in, and suitable tutorial videos would typically be found. Live classes conducted by music teachers were also viewed. If a particular teacher's instruction was appreciated, their recorded courses might be purchased, or even offline lessons might be attended. The TikTok platform has been regarded as a new method of vocal music instruction, where the advantages of online education—particularly in terms of resource integration—have been more effectively demonstrated.

3. Developing a pop vocal music teaching guide for TikTok by integrating data

3.1. The advantages and disadvantages of vocal music teaching on the TikTok platform, as well as the techniques and methods used

In order to study the advantages and disadvantages of vocal music teaching on the TikTok platform and the techniques and methods used, semi-structured interviews and observations were conducted on popular vocal music teachers and students on TikTok in China. The survey results are as follows:

TikTok offers distinct advantages for online pop vocal education, primarily through flexibility, accessibility, and cost-effectiveness. For teachers, the platform enables flexible scheduling, eliminates geographical barriers, reduces operational costs (no physical classroom/equipment needed), and provides revenue streams via paid courses and live gifts. Personalized teaching is facilitated through student feedback and segmented content, while features like video classification and accompaniment tools ease teaching burdens. Students benefit from fragmented learning via short videos, low-cost or free resources, diverse teacher expertise (including professionals and celebrities), and engaging, entertaining content that boosts motivation. However, challenges persist. Technical issues like signal delays, audio distortion, and equipment dependency hinder live interaction and accurate feedback. Teachers struggle with limited face-to-face guidance, while students face inconsistent teaching quality and distractions due to the platform's entertainment nature. The one-to-many model lacks personalized attention, and complex features pose a learning curve for some educators. Despite its transformative potential, TikTok teaching requires balancing convenience with pedagogical rigor to address these limitations.

Data shows that effective TikTok pop vocal teaching employs a hybrid approach: short videos for concise skill demonstrations (e.g., breathing exercises, belting techniques) and live streams for real-time interaction, feedback, and detailed explanations. Teachers utilize equipment like microphones, keyboards, and vocal models to enhance audio-visual clarity and engagement. Content is organized into thematic series (beginner/advanced levels, genre-specific tutorials) to ensure structured learning, complemented by learning groups for peer sharing and teacher-student feedback. Key techniques taught include mixing (blending chest/head voice), falsetto, breath control, vocal cord closure, and high-pitch mastery, presented through practical, engaging tutorials. This blend of accessible formats and targeted techniques caters to fragmented learning while fostering skill development and interaction.

3.2. Observing successful actual teaching cases on the TikTok platform

The TikTok platform can integrate better vocal music teaching resources. TikTok has attracted many good vocal education teachers or groups, or even stars to teach on the platform due to the huge number of users. There are many successful cases, among which two successful vocal music teaching cases are selected for analysis. The first case is SOU-E singing teaching. On TikTok, the platform flow of Enterprise, a music teaching head represented by “SOE singing teaching,” has a significant effect. The total number of short videos played has exceeded 100 million.

Why is SOE so popular? Her short teaching videos are rich in content, covering all kinds of vocal music knowledge points, which are relatively simple and easy to learn. The content of the teaching video is also relatively clear. For example, the lyrics are easy to see, and the positions of various vocal music symbols are more accurate. Students need to pay attention to which part is clearly marked, which is conducive to their better learning.

In the interview, most of the teachers preferred Teacher Yisheng’s teaching mode. Yisheng is a male vocal music teacher at a university. He has 4.2 million fans as of now. He mainly teaches through live streaming, which is free, but usually attracts many people to pay for his courses. His TikTok homepage shows many carefully recorded teaching videos by him. In his class, he only uses the piano or guitar. He is always able to explain in a simple and vivid way, perfectly demonstrating his unique teaching method. In addition to explaining the basic techniques of breathing, pronunciation, and singing, he also incorporated a lot of his own understanding and experience of the details.

There are many excellent pop vocal music teachers on the TikTok platform. Observing their teaching can enable us to learn a lot, and their teaching methods also provide reference and assistance for the following guide.

3.3. TikTok vocal music teaching guide

To excel in TikTok pop vocal education, educators should adhere to a structured guide emphasizing professionalism, innovation, and student-centered strategies:

Professional competence: Develop strong vocal techniques (e.g., mixing, breath control) and music theory knowledge, continuously updating skills through training to deliver accurate, in-depth instruction.

Technical setup: Invest in high-quality equipment (microphones, keyboards, lighting) to ensure clear audio-visual quality, enhancing demonstration accuracy and student engagement.

Structured content design: Organize lessons into phased series (beginner to advanced) and thematic categories (e.g., “Breath Control,” “Song Interpretation”) to cater to diverse learning needs and improve content discoverability.

Hybrid teaching model: Combine short videos (1–3 minutes) for concise skill breakdowns (e.g., falsetto

techniques, vocal cord closure) with live streams for real-time interaction, personalized feedback, and detailed explanations of complex concepts.

Innovation and personal branding: Cultivate a unique teaching style—humorous explanations, genre-specific expertise, or storytelling—to stand out, leveraging trends and interactive features (duets, challenges) to boost engagement.

Edutainment approach: Make lessons enjoyable through entertaining formats (e.g., popular song breakdowns, visual aids) to sustain student motivation and simplify technical content.

Individualized instruction: Use comments, private messages, and fan groups to understand student needs, offering tailored advice and regular feedback to address individual vocal characteristics and goals, ensuring safe and effective skill development.

By integrating these strategies, teachers can leverage TikTok's strengths to create accessible, engaging, and impactful vocal education, balancing convenience with pedagogical rigor to meet learners' diverse needs.

4. Conclusion

The TikTok platform of vocal music teaching as a new kind of vocal music teaching mode, better reflects the online teaching resources to promote the basic vocal music knowledge configuration and its advantages. As the economy increases continuously, with the support of national policy and emphasis on quality education, online music education targets will still continue to rise, and the market demand is huge. For teachers, this is both an opportunity and a challenge, we must embrace the Internet, not refuse and escape. In this era of rapid development, continuous learning and thinking can lead us better transformation and innovation, and also better promote music education. Although the development of online music education is in full swing, instruments or singing are highly dependent on the characteristics of the teacher, so that traditional music education forms still maintain advantages in terms of teaching experience and effect. In the author's opinion, the mainstream trend of music in the future will be that online and offline models complement each other, and no one will replace the other. The combination of the two will further promote the overall development of music education.

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A Study on the “Truth-Seeking and Utility-Attaining” in Julia Lovell’s Translation of *The True Story of Ah Q* from the Perspective of Translator Behavior Criticism

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Abstract: This study employs the framework of translator behavior criticism to conduct a systematic examination of Julia Lovell’s English translation of *The True Story of Ah Q*, utilizing the “intra-translation and extra-translation dichotomy.” The research investigates how extra-translation factors—such as the translator’s identity, translation motivations, and target readership positioning—shape the formation of the translated text. Through an analysis of intra-translation elements, including linguistic stylistic features, strategies for handling culture-loaded terms, and the use of paratexts, the study reveals the dynamic balance of Lovell’s translation within the “truth-seeking—utility-attaining” continuum. The findings demonstrate that as a Western sinologist-translator, Julia Lovell’s cultural identity, combined with the market-oriented approach of Penguin Books, has collectively shaped a distinctly “reader-oriented” characteristic in her translation. In rendering culture-specific items, she predominantly adopts domesticating strategies, enhancing readability through simplified sentence structures and other accessibility measures to achieve utilitarian goals. Simultaneously, the translator retains an appropriate degree of foreignness in the treatment of key cultural concepts, reflecting a dialectical balance between “authorial fidelity” and “reader adaptation.”

Keywords: Translator behavior criticism; *The True Story of Ah Q*; Truth-seeking—utility-attaining continuum

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1. Introduction

Since its publication in 1921, Lu Xun’s *The True Story of Ah Q* has held a pivotal position in modern Chinese literary history, with its global influence expanding through numerous translations. Among the various English renditions, *The Real Story of Ah-Q and Other Tales of China: The Complete Fiction of Lu Xun*^[1], translated by British sinologist Julia Lovell and published by Penguin Classics, has garnered significant scholarly attention due to its distinctive translational style and broad market reception. Research on Lovell’s translation has yielded

a substantial body of academic work. A review of existing literature reveals that current studies primarily follow three analytical trajectories: comparative analysis of translations, examination of translation strategies, and investigation of dissemination and reception effects.

In the domain of comparative translation studies, Zhu's ^[2] application of the "truth-seeking—utility-attaining continuum" evaluation model to analyze four major English translations offers particularly illuminating insights. The study reveals that George Kin Leung's version demonstrates the highest degree of truth-seeking, while Julia Lovell's translation exhibits the most pronounced utility-attaining orientation. The renditions by Yang Xianyi & Gladys Yang and William Lyell, though comparable in truth-seeking, display marked differences in their utility-attaining approaches. While this research effectively maps the distributional characteristics of these translations along the continuum, it does not sufficiently explore the intrinsic relationship between translators' identities/backgrounds and their strategic choices. Guo's review ^[3] further notes that existing scholarship has predominantly focused on the Yangs' and Lyell's translations, with research on Lovell's version remaining limited in both quantity and theoretical depth—often confined to superficial descriptive analyses. Regarding translation strategy analysis, Wu and Guan's diachronic study ^[4] observes that Lovell's translation "prioritizes fluency and target-reader acceptability while maintaining source-text fidelity," yet fails to situate this finding within a systematic theoretical framework. Huang and Feng's corpus-based comparative study ^[5] identifies a clear divergence between diasporic Chinese translator Chi-chen Wang and native-English translator Lyell: the former leans toward truth-seeking, whereas the latter emphasizes utility-attaining. This finding provides a critical reference for understanding Lovell's behavioral tendencies as a Western translator. Nevertheless, three significant research gaps persist: Insufficient specialized studies on Lovell's translation, with most existing work remaining descriptive rather than analytical; Lack of organic integration between translators' social factors (e.g., cultural identity, translation motivations) and concrete linguistic choices (e.g., lexical, syntactic features); Absence of systematic investigation applying the "intra-translation and extra-translation dichotomy" from translator behavior criticism to Lovell's rendition.

In light of these considerations, the present study transcends the binary opposition paradigm prevalent in traditional translation studies. Grounded in Zhou's ^[6] translator behavior criticism framework, it conducts a rigorous examination of Julia Lovell's translational behavior, systematically investigating both her truth-seeking endeavors to preserve source-text meaning and her utility-attaining strategies to fulfill target-culture demands. Methodologically, this study adopts Zhou's ^[7] framework of "intra-translation and extra-translation dichotomy" as its analytical approach. The investigation proceeds along two complementary dimensions to achieve a comprehensive understanding of the translator's behavior. On one hand, it examines the extra-translational social factors that influence the translation process. These include the translator's professional identity and cultural background, the underlying motivations for undertaking the translation project, the anticipated target readership, and the specific requirements set forth by the publishing house. These external elements collectively shape the translator's decision-making process and strategic orientation. On the other hand, the study conducts a meticulous analysis of intra-translational linguistic manifestations present in the target text. Particular attention is paid to lexical selections, syntactic features, and the handling of culture-specific terms. Furthermore, the research scrutinizes paratextual elements such as prefaces, footnotes, and annotations, which often reveal significant behavioral traces of the translator's intervention.

By situating these findings within the dynamic framework of the "truth-seeking—utility-attaining continuum evaluation model," the study aims to systematically assess the translator's behavioral tendencies along the spectrum between source-text fidelity and target-reader adaptation. This analytical approach ultimately

seeks to uncover how Julia Lovell's translation negotiates the delicate balance between maintaining faithfulness to Lu Xun's original authorial intent while simultaneously accommodating the expectations and comprehension needs of English-language readers. The methodology thus provides a robust framework for understanding translator behavior as existing within a complex network of linguistic choices and socio-cultural considerations, rather than as a series of isolated decisions. This dual perspective allows for a more multidimensional examination of how various factors interact to shape the final translated product.

2. Theoretical framework of translator behavior research

Traditional translation studies have long prioritized fidelity to the source text as the fundamental criterion, emphasizing the degree of faithfulness in target texts. However, such static analytical approaches exhibit significant limitations in accounting for the complexity of translation as an activity, particularly in addressing contextual, social, and human factors. With the evolution of translation studies, scholars have increasingly recognized that translation is not merely a linguistic transfer but also a form of social communication, wherein the agency and behavior of translators play a decisive role. Consequently, the research paradigm has shifted from a text-centric approach to a humanistic perspective, emphasizing a translator-oriented analytical framework. Within the humanistic paradigm, translator behavior research emphasizes the translator's agency, motivations, and behaviors, while emphasizing the social and dynamic nature of translational practice. This approach extends beyond conventional concerns with conceptual, connotative, collocative, and thematic meanings to incorporate social meaning (how translations function in target cultures), affective meaning (emotional resonance with readers), and reflective meaning (broader ideological implications). This research approach examines not only textual fidelity but also the translator's behavioral manifestations in socio-cultural contexts and their impact on translation practices. Within the humanistic paradigm, translator behavior research not only examines the textual comparison but also investigates the translator's agency in the translation process and its broader societal implications. It can be argued that examining translation phenomena and issues from a sociological perspective reflects theoretical sophistication and scientific validity. Traditional purely linguistic-textual approaches fail to account for the complexity of translation as a social activity. In contrast, building upon a tripartite analytical model encompassing textual, behavioral, and social dimensions, translator behavior research develops an integrated evaluation system that systematically examines translation as a multidimensional practice. The textual dimension examines the target text's fidelity to the source text and its linguistic quality; the behavioral dimension investigates the translator's motivations, strategies, and behaviors; While the social dimension assesses the target text's societal impact and reception in the target culture. This integrated evaluation framework not only offers a more comprehensive understanding of translation phenomena but also provides a more objective and scientific approach for translation criticism.

In practical application, the "truth-seeking—utility-attaining" continuum evaluation model requires researchers to analyze translator behavior through both textual and behavioral dimensions. First, from the behavioral dimension, researchers must examine the social impact and external factors influencing the translation act. This includes the translator's sociocultural background, cultural identity, translation purpose, target readership expectations, and market positioning. By analyzing these extrinsic factors, researchers can discern the societal pressures and expectations shaping the translator's decision-making process. For instance, translators may adapt source texts to accommodate target-culture norms or adopt specific strategies to meet market demands. This approach highlights the socially embedded and dynamic nature of translation, revealing

the sociological determinants of translator behavior. This stage evaluates the translator's performance in "utility-attaining"—demonstrating how translators negotiate external constraints to fulfill societal needs, representing the extra-translational research approach. Second, from the textual dimension, researchers must assess the target text's fidelity to the source text's meaning, focusing on intralinguistic challenges and semantic reconstruction, which include the degree of fidelity to the source text, linguistic quality of the target text, treatment of culture-bound terms, and syntactic restructuring for readability. Through these intrinsic analyses, researchers evaluate the translator's linguistic performance in meaning transfer, uncovering the translator's language-oriented behaviors. For example, translators may strategically manipulate cultural references or adjust syntactic structures to enhance coherence. This intra-translational approach emphasizes the linguistic and fidelity-bound aspects of translation, exposing the textual constraints governing translator behavior. The objective here is to determine the translator's adherence to "truth-seeking"—their efforts to achieve linguistic accuracy and semantic equivalence.

In the operation of this framework, Zhou claimed that researchers should observe the following key considerations: First, when assessing textual fidelity, rigid absolutism must be avoided, as the "truth-seeking" and "utility-attaining" principles exist in a state of dynamic balance. Translators may strategically compromise certain degrees of source-text fidelity to achieve functional adequacy when situational demands require, and vice versa. Second, the analysis of translator behavior should be conducted considering multiple factors such as the translator's individual background and professional habitus, the socio-cultural constraints of both source and target contexts, and the purpose of the translation project. These intersecting factors collectively shape the translator's decision-making process. Finally, researchers should avoid using unidimensional analysis by integrating textual and behavioral approaches, thereby illuminating the inherent complexity and dynamic nature of translator behavior through multidimensional investigation. Therefore, a translator should strive for optimal semantic fidelity ("truth-seeking" behavior) on the intra-translational dimension, and make necessary adaptations to fulfill socio-cultural needs ("utility-attaining" behavior) on the extra-translational dimension. The negotiated balance between these dimensions demonstrates the rationality of translational decisions within specific contextual constraints.

In summary, translator behavior criticism can address the limitations of traditional translation studies. By focusing on translators' agency and behavioral patterns, it provides a comprehensive understanding of the social and dynamic nature of translation activities. This research approach not only enhances the objectivity of translation criticism but also offers more effective guidance for translation practice, thereby advancing translation studies to a deeper level of development.

3. Extra-translational examination: Julia Lovell's translator identity and motivations

The Critical Theory of Translator Behavior emphasizes that translation is not merely a linguistic transfer process but also a sociocultural act, shaped by multiple factors, including the translator's identity, motivations, and target-reader positioning. As the English translator of *The True Story of Ah Q*, Julia Lovell's distinct cultural identity and explicit translation motivations profoundly influenced the form and direction of her rendition.

Julia Lovell, a prominent contemporary British sinologist and translator, currently serves as Professor of Modern Chinese History and Literature at Birkbeck, University of London. Compared to previous translators of *The True Story of Ah Q*, Lovell's cultural identity exhibits distinctive characteristics: she is neither ethnically

Chinese (unlike George Kin Leung, Chi-chen Wang, or Yang Xianyi) nor a specialist in Lu Xun studies (unlike William Lyell). Instead, she operates as a cross-cultural mediator—a “China expert” active in both academic and mainstream publishing. This unique positioning enables her to maintain critical cultural distance while leveraging her scholarly training to penetrate the textual essence of Chinese literary classics. Lovell has openly acknowledged that she is “not a Lu Xun specialist,” undertaking the translation primarily out of personal interest and at the commission of Penguin Books ^[8]. This dual “outsider-insider” status endows her translation with a hybrid quality—simultaneously scholarly and accessible.

From an academic standpoint, Julia Lovell graduated from the University of Cambridge’s Chinese Studies program in 1998, specializing in contemporary Chinese writer Wang Shuo during her doctoral research before shifting her focus to modern Chinese history. This interdisciplinary training spanning literature and history enabled her to balance both literary artistry and historical contextualization when translating *The True Story of Ah Q*. Unlike William Lyell, whose approach prioritized Lu Xun scholarship, Lovell emphasized accessibility for general readers, as evidenced in her translator’s introduction: “I want English-language readers to approach Lu Xun’s fiction as literature rather than as sociohistorical documents” ^[9]. This methodological stance directly influenced her parsimonious use of annotations—employing merely 3 footnotes and 7 endnotes throughout, a stark contrast to Lyell’s version with 67 detailed explanatory notes. This strategic approach to annotation reflects not only Lovell’s consideration for general readers but also her profound understanding of the social dimensions of translation. She maintains that excessive annotations may increase readers’ cognitive load, thereby compromising the text’s readability and appeal. Consequently, she employs alternative strategies—such as simplifying syntactic structures and embedding cultural explanations—to align the translation with target readers’ expectations, thereby enhancing both its accessibility and reception.

Lovell’s translation motivation exhibits a dual nature: on one hand, it stems from her genuine appreciation of Lu Xun’s literary merit; on the other, it reflects a deliberate strategy to introduce Chinese literature into the mainstream English-language book market. As she noted in an interview: “Compared with China’s Foreign Languages Press or academic publishers like Columbia University Press, Penguin enjoys much stronger brand recognition among Western readers, making it more effective in bringing Chinese literature into the mainstream publishing market” ^[8]. This market-oriented approach to translation stands in sharp contrast to Yang Xianyi’s principle of “adhering as closely as possible to the source text” ^[9], inevitably leading Lovell’s version to prioritize the “utility-attaining” dimension. As one of the most influential commercial publishers in the West, Penguin Classics imposes unavoidable market-driven constraints on its translations. Known for catering to general readers with high-quality paperback editions, the “Penguin Classics” series requires its selected works to meet specific readability standards. Lovell openly acknowledged this influence: “To enhance the translation’s fluency, I minimized the use of footnotes and endnotes... When encountering culturally dense passages that would require lengthy explanations, I opted for syntactic simplification” ^[1]. Such strategies—clearly shaped by the publisher’s market positioning—highlight the socially conditioned nature of translator behavior. In contrast, academic presses (e.g., University of Hawaii Press) prioritize scholarly rigor, as seen in Lyell’s meticulously annotated edition. This dichotomy underscores how institutional publishing contexts fundamentally shape translational outcomes.

Lovell’s explicit positioning of target readers constitutes one of the defining factors shaping her translational behavior. She conceptualizes her primary readership as “educated general readers in the English-speaking world” ^[8] rather than specialists in Chinese literature. This deliberate orientation predisposes her toward domestication strategies when handling culture-specific items, prioritizing idiomatic accessibility over

literal fidelity. For example, Lovell renders “胡说” (*húshuō*) as the English idiom “shoot one’s mouth off” (rather than the literal “talk nonsense”); the translation of “而立之年” (*ér lì zhī nián*) is “at the age of thirty—the year in which Confucius enjoined men to stand firm,” which is embedded with cultural explanation. This intratextual contextualization deliberately avoids supplemental annotations. This domestication strategy not only enhances the target text’s conformity with the reading habits of its intended audience but also significantly improves its readability and acceptability. Through this approach, Julia Lovell successfully transforms Lu Xun’s literary work into a text that is both comprehensible and appealing to general English-language readers, thereby achieving her “utility-attaining” translation objective. It is noteworthy that Julia Lovell’s approach transcends mere reader expectation accommodation, instead maintaining measured cultural heterogeneity within acceptable parameters. A representative case is her treatment of “黄酒” (*huángjiǔ*)—a culturally loaded term specific to Shaoxing region. Rejecting the fully domesticated “wine,” she opts for “rice wine,” which achieves dual objectives of accurate cultural authenticity and avoidance of comprehension barriers from excessive foreignization. This balancing act demonstrates the translator’s dual commitment to cultural authenticity and reader accessibility—the primary reason for the translation’s success in popular and scholarly reception.

Lovell’s translation strategy demonstrates not only her profound understanding of the social dimensions of translation, but also her ability to dynamically balance between “truth-seeking” and “utility-attaining” principles. An effective translation must address both linguistic accuracy and readability while simultaneously considering its impact on target readers. Through this balanced approach, she has successfully rendered Lu Xun’s literary works into texts that are both accessible to general English readers and faithful to the original’s cultural distinctiveness and literary value.

4. Intra-translational analysis

The Critical Theory of Translator Behavior claims that translators’ socially conditioned choices ultimately manifest themselves through concrete linguistic forms, leaving observable and analyzable “behavioral traces.” At the extra-translational level, Julia Lovell’s approach demonstrates a distinct utility-attaining orientation, shaped by her identity as a Western sinologist, Penguin Books’ market-driven agenda, and her prioritization of general readership needs. However, as emphasized by translator behavior criticism, social and linguistic dimensions are not dichotomous but dialectically interrelated. While catering to reader expectations, Lovell’s translation simultaneously engages creatively with Lu Xun’s stylistic particularities at the intra-translational level. Through multiple textual interventions, she negotiates a dynamic balance between truth-seeking and utility-attaining principles.

4.1. Stylistic features and readability strategies

In lexical selection, Julia Lovell demonstrates a marked preference for contemporary English usage, employing colloquial expressions and informal vocabulary to enhance textual vitality and align with modern readership expectations. Compared to Yang Xianyi’s and William Lyell’s versions, Lovell’s treatment of profanity proves particularly audacious.

Case analysis: Profanity translation in **Table 1**.

Table 1. The iconic epithet “妈妈的” (*māmā de*)

Translator	Translation	Strategy
Lovell	Bastard/Damn you	Modern vernacular equivalents
George Kin Leung	You bad fellow/you rascals	Early 20th c. euphemisms
Yang & Gladys	Curse you	Literary mitigation

The three distinct translations of “妈妈的” exemplify varying linguistic styles and readability features that reflect the translation orientations shaped by their respective historical and ideological contexts. Julia Lovell’s contemporary colloquial rendering as “Bastard/Damn you” preserves the original’s sexual connotation (with “bastard” literally meaning “illegitimate child”) and direct aggressiveness, mirroring the linguistic characteristics of underclass characters in modern film/literature. By employing contemporary profanity to achieve functional equivalence in emotional impact ^[10], this version enables immediate comprehension of the rage by modern English readers, creating direct emotional resonance for 21st-century audiences. George Kin Leung’s 1920s version ^[11], “You bad fellow/you rascals,” demonstrates colonial-era gentrification, diluting street vulgarity into moralistic didacticism that sanitizes Ah Q’s proletarian image into childish mischief. The translator’s “civilizing” tendency as a colonial elite and adherence to decorum standards sacrifice sociolinguistic authenticity, softening Ah Q’s vulgar persona into a “mischievous child” archetype. Yang Xianyi and Gladys Yang’s Cold War-era “Curse you” strikes a balance between political exigency and literary fidelity, abstracting the profanity into biblical terminology that retains the essence of anger while eliminating specific offensive content, thereby conforming to the “civilized discourse” requirements of socialist foreign propaganda.

Collectively, these three approaches form a continuum of translation ethics—ranging from Lovell’s reader-oriented approach (maximizing readability), to Yang’s politically-driven orientation (ensuring cultural safety), and Leung’s morally-guided strategy (emphasizing civilized edification)—revealing how power dynamics across different historical periods shape translation strategies.

For another example, Ah Q’s “revolutionary proclamation”:

“革这伙妈妈的命，太可恶！太可恨！”

Lovell: “There’s a whole bunch of fuckers I’d like to revolution clear out of this world and into the next, the sorry bastards!” ^[1]

Chi-chen Wang: “the detestable, loathsome things” (lexical softening)

Lyell: “the sorry bastards” (partial domestication)

Julia Lovell’s rendition employs highly provocative contemporary English expletives like “fuckers” and “sorry bastards,” which stand in sharp contrast to Chi-chen Wang’s more restrained “the detestable, loathsome things” and William Lyell’s relatively muted “the sorry bastards.” While Lovell’s bold approach may deviate from strict source-text fidelity in the “truth-seeking” dimension, it effectively achieves “utility-attaining” objectives by successfully recreating the original’s emotional intensity. This strategic choice enables English-language readers to viscerally experience Ah Q’s profound resentment and frustration.

Beyond profanity, Lovell’s translation demonstrates a distinct modernization tendency in its lexical choices. For instance, she renders “秀才” as the generic “scholar” rather than the more culturally precise “xiucaì” or “cultivated talent.” Similarly, the traditional gambling term “押牌宝” is simplified to “gamble,” in contrast to Lyell’s more detailed translation “play a round of Pick-a-side.” While these choices sacrifice certain culture-specific nuances, they significantly enhance the text’s readability, aligning perfectly with Penguin Classics’ market positioning as a mainstream literary series.

At the syntactic level, Julia Lovell demonstrates a clear preference for simplifying complex structures, dividing long sentences, and adjusting word order to better align with English idiomatic patterns. Statistical analysis reveals that Lovell’s translation has an average sentence length of 16.71 words, shorter than Chichen Wang’s 17.39 words ^[5], indicating relatively simpler sentence structures. Simultaneously, Lovell’s version shows higher sentence length dispersion (73.85) compared to Wang’s (55.33), reflecting more frequent alternation between short and long sentences that creates richer rhythmic variation—a stylistic feature that enhances both the literary quality and readability of the text. A representative example can be seen in the translation of “塞翁失马安知非福.” Lovell renders this as “losing can sometimes be a blessing in disguise” ^[1], substituting the classical allusion with a concise English proverb, whereas Wang provides a literal translation: “who knows that it is not a blessing for the Tartar to have lost his horse?” ^[12], preserving the cultural reference to “the old frontiersman” at the cost of immediate comprehension. While Lovell’s simplified approach sacrifices certain cultural particulars, it achieves superior instant comprehension—a strategic choice perfectly consistent with her target audience of general readers. Another notable example of syntactic restructuring appears in the psychological depiction of Ah Q: “他赢而又赢，铜钱变成角洋，角洋变成大洋，大洋又成了叠。” Lovell creatively divides this into three concise sentences: “Ah Q won! He won again! And then again he won some more! Copper pennies turned into silver dollars, and the dollars piled up into a tall stack.” ^[1] By employing exclamatory sentences and parallel structures, she vividly recreates Ah Q’s gambling excitement and the accumulating wealth. In contrast, Wang’s version maintains the original as a single extended sentence: “He won and won, his coppers turning into dimes, dimes into silver dollars, silver dollars growing into a big pile.” ^[11]. While accurate in semantic terms, Wang’s translation lacks the dynamic immediacy of Lovell’s rendition.

A readability assessment conducted with the BFSU-Huge Mind Readability Analyzer reveals that Lovell’s translation outperforms Wang’s version across all measured metrics, demonstrating superior accessibility for contemporary English readers (**Table 2**).

Table 2. A readability assessment conducted with the BFSU-Huge Mind Readability Analyzer

Readability metric	Lovell’s translation	Wang’s translation	Interpretation
Flesch Reading Ease (FRE)	73.52	70.51	Higher score = Easier to read
Flesch-Kincaid Grade Level (FK)	7.16	7.75	Lower score = Requires less education
Gunning Fog Index (GFI)	18.08	20.04	Lower score = Fewer reading obstacles

Note: FRE >70 = “easy”; FK 7-8 = US middle school level; GFI >18 = “difficult” for general audiences; Data source: Huang and Feng ^[5]

The data shows that Lovell’s higher FRE score (73.52 vs. 70.51) confirms better immediate comprehension for average readers; the lower FK grade level (7.16 vs. 7.75) suggests Lovell’s text is accessible to younger or more casual readers, and the improved GFI (18.08 vs. 20.04) indicates fewer complex sentence structures and jargon.

The data corroborate the success of Julia Lovell’s concerted efforts to enhance the readability of her translation. It is noteworthy that this improved accessibility is not achieved at the expense of the source text’s core meaning. When handling key concepts and culture-loaded terms, the translator maintains an appropriate degree of heteroglossia—for instance, rendering “黄酒” as “rice wine” rather than the fully domesticated “wine,”

and translating “翰林” as “Hanlin academician” instead of the culturally diluted “imperial scholar.” This balanced approach ensures that the translation neither alienates general readers through excessive foreignization nor sacrifices cultural distinctiveness through radical domestication, exemplifying the translator’s judicious balance between “truth-seeking” and “utility-attaining” principles.

Stylistic analysis reveals that Julia Lovell’s translation is characterized by its colloquial and contemporary lexical choices, flexible and concise syntactic structures, and the resulting high readability. These features collectively serve a central purpose: to enhance the accessibility and appeal of Lu Xun’s classic text for contemporary general English-language readers. From the perspective of translator behavior criticism, this demonstrates the translator’s strong “utility-attaining” orientation. However, this approach should not be mistaken for unprincipled compromise; rather, it represents a creative reconstruction grounded in thorough comprehension of the source text.

4.2. Culture-loaded terms and paratextual strategies

The Critical Theory of Translator Behavior emphasizes that the treatment of culture-specific items serves as a crucial window into observing a translator’s behavioral tendencies. In her translation of *The True Story of Ah Q*, Julia Lovell demonstrates systematic and strategic choices when dealing with the text’s rich array of culture-loaded terms—choices that are closely tied to her identity as a translator and her positioning of the target readership. Simultaneously, as a key intratextual element, her use of paratexts (including prefaces, annotations, and appendices) reflects her dedicated balancing act between “truth-seeking” and “utility-attaining.”

The True Story of Ah Q abounds with culturally specific references deeply rooted in Chinese contexts, such as: Imperial examination terms (*xiuca* 秀才, *Hanlin* 翰林), traditional customs (*ya paibao* 押牌宝, *huangjiu* 黄酒), and folk sayings (*Sai Weng Shi Ma*, *An Zhi Fei Fu* 塞翁失马安知非福). Lovell’s approach to these terms forms a strategic spectrum, ranging from full domestication to moderate foreignization, dynamically distributed along a continuum based on contextual demands (Table 3).

Table 3. Distribution of Julia Lovell’s translation strategies for culture-loaded terms

Strategy type	Example	True-seeking degree	Utility-attaining degree	Application context
Full domestication	“秀才” → “scholar”	Low	High	Concepts with low cultural specificity
Moderate adaptation	“黄酒” → “rice wine”	Medium	Medium	Cultural terms needing basic distinction
Limited foreignization	“太极图” → “Taiji symbol”	High	Low	Proper nouns with some target-culture recognition
Embedded explanation	“而立之年” → “at 30 in which Confucius enjoined men to stand firm”	Medium-high	Medium	Important but obscure cultural concepts

At the fully domesticated end of the spectrum, Lovell frequently employs cultural substitution, replacing source-text concepts with target-culture counterparts, for example, “秀才” → “scholar,” “地保” → “local constable,” “押牌宝” → “gamble.” While such translations sacrifice cultural specificity, they ensure immediate comprehension, aligning with general readers’ expectations. This is particularly evident in her treatment of profanity:

- (1) “忘八蛋” → “bastard” (functional equivalence for “son of a turtle”)

(2) “小乌龟子” → “beggar” (pragmatic adaptation of “little turtle”)

In the moderate adaptation zone, Lovell adopts a “literal translation and explanation” strategy, integrating cultural information directly into the text rather than relying on annotations, for example,

(3) “而立之年” → “at the age of thirty—the year in which Confucius enjoined men to stand firm”

(4) “黄酒” → “rice wine” (differentiating it from generic “wine”)

This approach minimizes paratextual intrusions while preserving essential cultural markers, demonstrating the translator’s negotiated compromise between fidelity and fluency.

For limited foreignization, Lovell selectively retains pinyin forms for culturally pivotal concepts:

(1) “阿 Q” → “Ah Q” (not “Ah Quei”)

(2) “太极图” → “Taiji symbol” (not “symbol of the Supreme Ultimate”)

Such choices target concepts with pre-existing recognition in English, where foreignization poses no significant comprehension barrier yet maintains controlled cultural otherness.

As to paratexts, Lovell adopts a deliberately restrained approach to them, starkly contrasting with Lyell’s heavily annotated version (67 detailed notes). Her translation contains only 3 footnotes and 7 endnotes, significantly fewer than typical academic editions. This economy stems from Penguin’s market-driven mandate for reader accessibility and the translator’s intent to present Lu Xun “as literature rather than sociohistorical document”^[1].

A paradigmatic example is her rendering of “黄金格的信” as “an extremely formal letter, shaped like an umbrella”^[1]. In *The True Story of Ah Q*, the “gold-grid letter” is a deeply satirical detail. During the late Qing and early Republican period, formal documents and upper-class correspondence often used luxurious gold-lined stationery as a symbol of prestige. In the novel, this letter is a forged official document that Landlord Zhao falsely attributes to a low-ranking military officer (“把总”) and sends to the Provincial Graduate, claiming to severely punish Ah Q’s “rebellion.” The extravagant stationery creates an absurd contrast with the rustic setting of Weizhuang Village. Originally a tool of elite social exchange, the gold-grid letter is here weaponized to suppress a landless laborer under fabricated charges—its rigid traditional formatting serving only to mask the abuse of power. Through this detail, Lu Xun exposes the gentry class’s hypocritical “performance of authority” and reveals how even Ah Q’s oppression is orchestrated as an elaborately staged farce, laying bare the empty formalism of rural power structures. Such a “tempest in a teapot” official document epitomizes the absurdity of old Chinese society. Julia Lovell’s translation of this phrase as “an extremely formal letter, shaped like an umbrella” represents a strategic cultural compromise. In Western contexts, the umbrella symbolizes ceremonial authority (e.g., the British parliamentary mace). Lovell replaces the Eastern-specific “gold-grid” with an instantly recognizable equivalent of formal grandeur, avoiding the confusion a literal “gold-grid paper” might cause. While this approach sacrifices certain material-cultural specifics (the visual/tactile qualities of gold-lined paper) and dilutes the original historical context, it prioritizes the transmission of the satirical intent. The exaggerated phrasing “extremely formal” effectively recreates Lu Xun’s ironic tone, preserving the text’s absurdness. This aligns perfectly with both the Skopos theory of translation and Penguin Classics’ mass-market positioning. It can be said that Lovell’s solution succeeds within the framework of popular literary translation. As translation has no absolute “right” or “wrong”—only appropriateness to purpose—her version masterfully serves its primary goal: making Lu Xun accessible as a canonical author for the English-speaking world.

Another illustrative example is Lovell’s endnote for “Hanlin”: “A member of the Hanlin Academy, an elite scholarly institution in imperial China”^[1]. This concise annotation provides only essential historical context. In contrast, Lyell’s note on the same term offers far more academic detail—including the Academy’s founding

date, functional evolution, and political role in the Qing dynasty ^[12]. Lovell's rationale for such paratextual minimalism is explicitly stated in her preface: "I want readers above all to enjoy these stories as works of literature... I have therefore kept scholarly annotation to a minimum, providing explanations only where strictly necessary" ^[1]. This prioritization of literariness over scholarly exhaustiveness directly serves her core objective: expanding the text's accessibility to general readers.

An analysis of Julia Lovell's treatment of culture-loaded terms and paratexts reveals a dialectical balance in her translational approach: while ensuring fundamental readability, she strategically preserves essential cultural heteroglossia; while minimizing scholarly annotations, she embeds necessary cultural explanations directly within the main text. This art of balance enables her translation to avoid both the elitist inaccessibility of excessive foreignization and the cultural erasure of radical domestication, ultimately maintaining the text's distinctive cultural character.

Data from Goodreads demonstrates Lovell's significant reach among general readers: her translation boasts a 3.92/5.00 average rating (based on 2,106 reviews), substantially higher than Wang Chi-chen's 3.58/5.00 (only 38 reviews). This popular acclaim aligns with scholarly endorsements—UC Irvine historian Jeffrey Wasserstrom praised it as "the most impactful work Penguin Classics has ever published in Chinese literature" ^[13]. The evaluation validates the translation's success in the "utility-attaining" dimension. It can be said that at the cultural transmission level, Lovell's translator behavior exhibits a hybrid orientation—predominantly "utility-attaining" yet retaining measured "truth-seeking" commitments. Through systematic strategic choices, she negotiates a personally distinctive balance between cultural authenticity and reader accommodation—one that leans toward pragmatism without wholly abandoning source-text culture. This orientation stems from both the cultural distance inherent to her identity as a Western sinologist and Penguin Classics' prioritization of market accessibility, representing the dynamic interplay between the translator's social agency and linguistic decision-making.

5. Conclusion

This study employs the Critical Theory of Translator Behavior within a "dualistic intra-/extra-translational framework" to systematically examine the production mechanisms and textual features of Julia Lovell's English translation of *The True Story of Ah Q*. At the extra-translational level, three sociocultural factors shaped Lovell's approach. First, her identity as a non-Chinese Western sinologist maintained deliberate "outsider-with-insight" cultural distance, prioritizing target-reader receptivity; secondly, as a Penguin-commissioned translator, she explicitly served market-expansion goals, elevating readability and fluency over scholarly precision; and thirdly, as a literary scholar rather than a Lu Xun specialist, she emphasized the text's universal literary merit over historico-political specificity. These factors collectively forged a reader-adaptive translational stance. At the intra-translational level, Lovell's behavioral traces manifest through several ways, namely the lexical modernization, syntactic streamlining such as clause segmentation and rhythmic variation for enhanced readability, a strategic spectrum for culture-loaded terms (ranging from full domestication to calibrated foreignization), and paratextual minimalism (sparse annotations to preserve literary immersion). These linguistic choices collectively produce a translation that negotiates the "truth-seeking—utility-attaining" continuum, leaning toward pragmatism while retaining measured cultural fidelity. The Lovell translation neither fully domesticates (risking cultural erasure) nor excessively foreignizes (alienating readers), but carves out an operational middle ground. Lovell's predominantly pragmatic yet culturally attentive approach offers

a replicable model for the global dissemination of Chinese literature and empirical development of translator behavior studies.

Translation is never merely an individual act, but rather a form of cultural production shaped by social forces. In translational practice, the translator's social identity and motivations manifest through concrete linguistic strategies, leaving observable and analyzable behavioral traces. The English translation of *The True Story of Ah Q* by Julia Lovell stands as a successful case of Chinese literature's global circulation in the new century, demonstrating how translators can creatively adapt within complex sociocultural contexts. In an era of globalized literary exchange, translators must make judicious strategic choices to negotiate an equilibrium between cultural authenticity and reader accessibility, enabling these seemingly competing demands to achieve a dynamic, harmonious coexistence.

Disclosure statement

The author declares no conflict of interest.

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Adapting High-Level Language Programming (C Language) Education in the Era of Large Language Models

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Abstract: With the widespread application of large language models (LLMs) in natural language processing and code generation, traditional High-Level Language Programming courses are facing unprecedented challenges and opportunities. As a core programming language for computer science majors, C language remains irreplaceable due to its foundational nature and engineering adaptability. This paper, based on the rapid development of large model technologies, proposes a systematic reform design for C language teaching, focusing on teaching objectives, content structure, teaching methods, and evaluation systems. The article suggests a teaching framework centered on “human-computer collaborative programming,” integrating prompt training, AI-assisted debugging, and code generation analysis, aiming to enhance students’ problem modeling ability, programming expression skills, and AI collaboration literacy.

Keywords: Large language models (LLMs); High-level language programming; C language; Human-computer collaborative programming

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1. Introduction

The High-Level Language Programming course is a key foundational course for computer science majors, responsible for the critical tasks of introducing programming thinking, training computational thinking, and developing initial engineering skills. As the core teaching language of this course, C language plays an irreplaceable fundamental role in the programming education system due to its concise syntax, rigorous structure, and proximity to low-level implementation. It has extensive applications in fields such as embedded development, system software construction, and data structure implementation.

In recent years, with the rapid development of artificial intelligence, particularly large language models (LLMs), intelligent tools represented by ChatGPT^[1], GitHub Copilot^[2], and others have demonstrated remarkable capabilities in text generation, semantic understanding, code generation, and debugging assistance.

Students are now able to interact with models through natural language, quickly generating well-structured, runnable C language programs^[3,4]. This trend is profoundly reshaping student learning behavior, teaching strategies, and the content structure of the course itself^[5].

However, most C language courses in current universities still follow the traditional teaching model of “teacher instruction + code practice,” which has limitations such as closed content, delayed feedback mechanisms, and one-dimensional interaction methods, making it difficult to meet students’ expectations for personalized, intelligent learning experiences in the modern era. At the same time, despite the strong assistive capabilities of large models, the challenge of how students can scientifically understand and use these tools, how to avoid over-reliance on technology, and how to enhance collaborative programming abilities has become an urgent issue in the teaching process^[6–8].

In this context, constructing a new paradigm for the High-Level Language Programming course that integrates the capabilities of large language models and focuses on “human-computer collaborative programming” is not only an upgrade and optimization of existing teaching content and methods, but also a key path to cultivate students’ engineering practice abilities and AI literacy in the future. Based on the current teaching status of C language courses in universities and the evolution trends of technology, this paper proposes a systematic teaching reform plan, exploring aspects such as the restructuring of teaching goals, content integration, teaching methods design, and the innovation of evaluation mechanisms, providing theoretical references and methodological support for the future implementation of teaching reforms.

2. Course background and reform opportunities

2.1. Course positioning and structure

High-Level Language Programming is a foundational course for computer science majors, typically taught in the first semester. It uses C language to help students understand program mechanisms and memory control principles, laying a foundation for subsequent courses like Data Structures and Operating Systems. The course is organized in four stages: basic syntax, control flow, data structures, and project practice. It emphasizes both technical skills and early development of programming thinking and engineering awareness.

2.2. Challenges in current teaching

Despite its structured approach, the traditional teaching model faces limitations in the context of AI and modern software development. The content is heavily focused on syntax and logic, with little integration of AI tools or modern engineering practices, making it difficult for students to connect theory with real-world applications. Furthermore, the learning process tends to be closed and imitative, with limited student exploration. Practical tasks are isolated, and there is insufficient feedback or guidance in debugging, affecting the development of problem-solving skills.

2.3. Opportunities for teaching reform with LLMs

The rise of LLMs offers new opportunities for reforming programming courses. LLMs, with their advanced language understanding and code generation abilities, can enhance students’ learning and problem-solving skills. In High-Level Language Programming teaching, LLMs can assist in generating code and providing real-time feedback during debugging. Prompt engineering offers dual training in language expression and problem modeling, enabling students to transition from understanding problems to coding solutions. This shift from “knowledge transfer” to “ability generation” can transform the course into a task-driven, human-AI

collaborative learning environment.

3. Teaching transformation pathways under AI empowerment

3.1. Shift in teaching philosophy and goal orientation

With the rapid development of LLMs, there is an urgent need for the transformation of C language teaching from a “syntax training-oriented” model to a “collaborative skills-oriented” approach. This reform centers on the core philosophy of “AI-assisted + problem-driven + critical collaboration,” emphasizing the systematic development of students’ expression, validation, and iteration abilities in the context of technological empowerment. The reform follows the fundamental principles of “balancing knowledge and skills, integrating theory and practice, and ensuring human-machine collaboration,” aiming to establish a new teaching system that is both in line with beginners’ cognitive development and oriented toward engineering practice.

To effectively implement this philosophy, the teaching objectives are broken down into five interrelated ability dimensions. First is language foundation ability, requiring students to master C language syntax, logical expressions, and modular design methods. Second is problem modeling ability, enabling students to abstract real-world problems into programming tasks and clearly express requirements using natural language. Third is prompt engineering ability, where students should be able to write high-quality prompts to guide AI models in generating structured and semantically accurate code. Fourth is AI collaboration and optimization ability, which includes evaluating, modifying, and debugging AI-generated results, fostering a collaborative mindset between humans and machines. Finally, engineering awareness and reflective ability are cultivated through project practice, focusing on code standards, development processes, and teamwork, with reflection aimed at enhancing programming literacy and problem-solving skills.

This multidimensional goal system not only covers the traditional focus on foundational knowledge but also introduces future-oriented collaborative intelligence literacy, creating a new teaching direction from “mastering tools” to “driving tools.”

3.2. Curriculum design and methodological innovation

Guided by the aforementioned ability framework, the course content design follows the principles of “solid foundation, clear progression, task-driven, and AI integration,” forming a four-level progressive module system: “basic syntax training—structural design deepening—AI collaboration introduction—engineering practice expansion.” In the initial phase, the course focuses on basic syntax elements such as variable definitions, data types, control structures, arrays, and functions, using simple cases and step-by-step exercises to help students build language foundations. In the middle phase, modular programming methods, debugging skills, and more complex structures like pointers and structs are introduced, enhancing students’ logical thinking and debugging abilities.

In the advanced phase, the teaching will systematically guide students in AI-assisted programming training, including strategies for writing prompts, interpreting model responses, and optimizing code. Teachers will organize students to analyze and refine AI-generated code, gradually developing their ability to critically engage with AI. Finally, students will engage in human-machine collaborative development practices in open-ended tasks, completing a full programming process from requirement analysis, prompt writing, functionality implementation, to process documentation and reflection, enhancing their engineering application skills.

To support the implementation of the curriculum, this proposal adopts a multi-faceted teaching approach, including case-driven, group collaboration, and feedback loops. The teaching design integrates real-world

problems into classroom tasks, guiding students to build prompts and generate initial solutions. Students are encouraged to work in groups on human-machine co-creation tasks, fostering the integration of diverse perspectives through collaborative division of labor. A three-level feedback mechanism, consisting of AI model feedback, peer evaluations, and teacher feedback, will be established to enhance the interactivity and targeting of learning. Additional resources, such as prompt template libraries, error case collections, and AI debugging manuals, will be developed to support students in understanding AI model behavior and optimizing generation logic.

3.3. Evaluation mechanism and ability feedback

To comprehensively reflect students' ability development in an AI-collaborative environment, this proposal establishes a teaching evaluation system that combines “formative + summative + reflective” assessments, emphasizing the feedback loop between ability evaluation and thinking reflection. During the course, formative assessments will focus on the accuracy of prompt design, the quality of AI interaction, and the optimization process, providing teachers with data to guide the teaching process. Summative evaluation will be carried out through small projects or group tasks, assessing students' engineering abilities in functional implementation, structural design, and adherence to standards. Additionally, a reflective evaluation section will be included, where students write reports on their use of AI, analyzing the strengths and challenges of collaborating with AI and identifying possible improvement paths.

This multidimensional evaluation mechanism focuses not only on “what students did right” but also on “how they did it” and “how they can improve,” building a feedback system that is oriented towards students' ability growth. It also helps teachers dynamically adjust teaching strategies, fostering a positive interaction between teaching and learning.

4. Feasibility and expected outcomes of the teaching reform

4.1. Teaching process and theoretical foundations

This teaching reform plan adopts a 15-week cycle, integrating the assistive capabilities of large language models into a progressive instructional process consisting of four stages: basic training, modular design, AI collaboration, and engineering practice.

In the first five weeks, instruction focuses on the fundamental syntax of C language, guiding students through concrete tasks to conduct preliminary prompt training and gradually build foundational skills in language expression and programming logic. Weeks six to ten emphasize structured programming and debugging, encouraging students to leverage AI for syntax and logic error detection, as well as for refining module design strategies.

Weeks eleven to fourteen are devoted to comprehensive project-based practice, during which students complete initial drafts with AI support, independently iterate and optimize their code, and document prompt design and collaborative workflows—thereby enhancing their abilities in system development and human-AI collaboration. In the final week, students present their projects and submit reflective reports on their use of AI, systematically reviewing their learning journey.

Visual Studio is recommended as the primary programming environment, complemented by web-based access to open-source LLMs such as DeepSeek. These tools support functionalities including auto-completion, debugging suggestions, and semantic code generation.

The instructional design is grounded in constructivist learning theory, emphasizing students' active

engagement and meaningful knowledge construction within task-driven contexts. Furthermore, insights from domestic and international studies on AI-assisted programming indicate that appropriately integrated AI tools can reduce beginner anxiety and entry barriers, while providing immediate feedback to enhance learners' diagnostic and reflective capabilities during debugging. Thus, from the perspectives of pedagogical structure, technical support, and cognitive development, the proposed teaching model demonstrates strong feasibility and theoretical soundness.

4.2. Evaluation of teaching outcomes and implementation challenges

Through the coordinated design of instructional goals and teaching processes, the reform initiative is expected to significantly enhance learning outcomes. On one hand, with AI assistance, students can improve both programming efficiency and code quality, leading to a more systematic understanding of syntax rules and structured expression. On the other hand, the process of prompt writing and iterative optimization fosters stronger problem awareness and continuous improvement capabilities. The reform also aims to stimulate students' intrinsic motivation, encouraging a shift from passive imitation to active design, and gradually cultivating essential skills for human–AI collaboration.

However, several implementation challenges may arise. First, the wide variation in students' programming abilities could pose difficulties; if the threshold for AI tool use is too high, less proficient students may become further marginalized. To address this, a tiered prompt task system can be introduced, along with personalized support resources, to lower the learning curve and ensure educational equity.

Second, LLMs can produce unstable or ambiguous outputs. If students overly rely on AI-generated content, their independent thinking abilities may be weakened. Therefore, the course should incorporate a “credibility alert” mechanism to guide students in critically evaluating AI responses.

Third, excessive dependence on AI might lead to a loss of control over programming details. To mitigate this, a prompt evaluation system centered on “refactoring and optimization” is recommended, emphasizing that AI outputs are references only, and requiring students to rewrite and reflect upon generated code.

In summary, this reform plan for High-Level Language Programming demonstrates high feasibility and innovation in terms of instructional design, theoretical underpinning, and technical deployment. It is expected to significantly improve the overall effectiveness of C language teaching. Nonetheless, careful attention must be paid to differentiated instruction and process management to avoid the risk of “outsourcing education to AI,” thereby achieving a deep integration of AI-powered teaching, learning, and assessment.

5. Conclusion

The rise of large language models has brought new opportunities for the development of the High-Level Language Programming (C Language) course. Based on the concept of human–AI collaboration, this paper proposes a comprehensive teaching reform plan that integrates AI tools into the instructional process. The reform systematically addresses course objectives, content structure, teaching methods, and evaluation systems, aiming to enhance students' abilities in problem modeling, prompt design, and collaborative programming.

The core of this reform lies in combining traditional syntax training with intelligent assistance, fostering the integration of knowledge acquisition and capability development. Looking ahead, continued refinement of this approach may be achieved through pilot teaching programs, platform development, and interdisciplinary course integration. Such efforts will further advance the curriculum toward greater intelligence and convergence in the era of AI.

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A Study on Teaching Design and Implementation of Automobile Practical Course Based on Project Teaching

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Abstract: Following the proposal of the “Emerging Engineering Education (EEE)” initiative, the cultivation of interdisciplinary innovative talents has gained increasing prominence. Currently, there exists a significant gap between the practical innovation capabilities of automotive majors in vocational colleges and the evolving demands of the industry. To address deficiencies in interdisciplinary innovative talent development programs, this study proposes an educational framework structured around “One Core, Two Dimensions, Three Levels.” Leveraging a project-driven teaching methodology and utilizing CATIA—the industry-standard 3D design software—as a central tool, we have developed a closed-loop teaching model integrating theory, modeling, simulation, and evaluation. This model underpins a newly designed automotive engineering practicum aimed at nurturing high-quality engineering talents equipped with three critical competencies: solving complex engineering challenges, digital design proficiency, and cross-disciplinary collaborative innovation. The proposed approach demonstrates potential to alleviate the structural disconnect between traditional engineering pedagogy and industry talent requirements.

Keywords: Interdisciplinary innovative talents; Project-driven; Practical innovation; CATIA

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1. Introduction

The rapid development of China’s automotive industry and its ever-evolving industrial landscape have imposed new requirements for the cultivation of technical talents in this sector ^[1]. In the context of rapid advancements in industrial innovation and manufacturing, an increasing number of emerging complex challenges cannot be resolved through isolated disciplinary approaches, necessitating interdisciplinary innovators capable of adapting to the new wave of technological revolution and industrial transformation to assume critical responsibilities in production innovation ^[2]. Against this backdrop, vocational colleges have significantly revised their training objectives and skill requirements for next-generation automotive technicians ^[3], positioning educational institutions as innovative practice platforms entrusted with cultivating professionals aligned with societal

development needs ^[4]. However, most current engineering talent development mechanisms in vocational colleges suffer from insufficient practical training, with predominant reliance on traditional teaching methods such as blackboard-based instruction and PowerPoint lectures. This approach conflicts with the interdisciplinary innovation principles emphasized in Emerging Engineering Education (EEE), while graduates' skill levels consistently fail to meet industry expectations. Amidst the accelerated growth of engineering R&D and intelligent manufacturing, engineering education must transcend the limitations of conventional pedagogy, making the cultivation of innovative talents with robust foundational knowledge and outstanding engineering capabilities a central focus of pedagogical research in vocational engineering education.

To develop interdisciplinary professionals capable of meeting automotive industry demands and bridging theoretical-practical gaps, this study integrates current employment market needs to design a practice-oriented curriculum centered on enhancing students' engineering practice capabilities, innovative thinking, and collaborative skills. Guided by the "One Core, Two Dimensions, Three Levels" pedagogical framework, the course development process involves: (1) systematic elaboration of instructional philosophies; (2) detailed curriculum design; (3) practical implementation through a case study employing CATIA for modeling and finite element analysis of a new energy vehicle's transmission solid axle; and (4) comprehensive multi-dimensional evaluation. By integrating theoretical instruction, digital modeling, software simulation, and outcome assessment within automotive design contexts, this curriculum effectively converges theoretical knowledge with practical skill development, providing innovative perspectives and implementable paradigms for vocational education reform.

2. Course introduction and teaching concept

The Automotive Design Practice Course (hereinafter referred to as "the Practice Course") is designed for final-year students majoring in Automotive Application and Maintenance and related disciplines. Integrating multidisciplinary knowledge from mechanical engineering, mechanics, and automotive engineering, this course systematically bridges theoretical foundations with practical applications to deliver comprehensive competency development. It serves a tripartite mission: cultivating professional literacy, enhancing holistic competencies, and empowering graduates for innovative career paths or advanced academic pursuits. Adopting a practice-driven approach centered on real-world engineering problem-solving, the course operationalizes the pedagogical framework of "One Core, Two Dimensions, Three Levels" to cultivate next-generation engineering innovators with interdisciplinary capabilities.

2.1. One Core

Compared to knowledge-centered curriculum development paradigms, student-centered pedagogical approaches demonstrate superior efficacy in enhancing learner engagement and knowledge acquisition. The Practice Course employs team-based learning structures where students self-organize into groups to collaboratively execute practical projects. Post-implementation, participants conduct critical self-assessments and peer evaluations through guided critical thinking exercises, emphasizing proactive participation and personalized learning trajectories to achieve iterative knowledge/skill enhancement throughout project cycles.

To investigate student preferences for instructional methodologies, a pre-implementation survey was administered to Automotive Application and Maintenance majors using a multiple-response questionnaire format. Analysis of 100 valid responses revealed distinct pedagogical expectations (as illustrated in **Figure 1**):

77% of respondents prioritized interest-driven curriculum customization, 55% endorsed self-directed research projects, while 51% emphasized hands-on involvement in full-cycle course design. These findings underscore students' strong preference for practical learning modalities that stimulate engagement while addressing multifaceted competency development needs.

Cross-analysis of learning behavior patterns examined two variables: X (post-graduation plans) and Y (problem-solving strategies). **Table 1** presents the distribution percentages of Y-variable manifestations across X-variable categories. Key observations include: (1) Predominant reliance on self-directed information retrieval when confronting academic challenges, indicating emerging self-regulated learning capabilities; (2) Significant minority preference for peer consultation, highlighting the critical role of collaborative learning ecosystems. Notably, 83% of participants advocated for personalized curricular structures, particularly interest-based course selection, providing novel insights for higher education curriculum optimization.

The survey conclusively demonstrates strong student endorsement of practice-oriented assessment mechanisms, particularly in applied disciplines. This empirical evidence necessitates pedagogical reforms prioritizing authentic learning experience design to cultivate holistic competencies. Collectively, these findings provide actionable guidelines for advancing technical education through customized curriculum development and enhanced practical training integration.

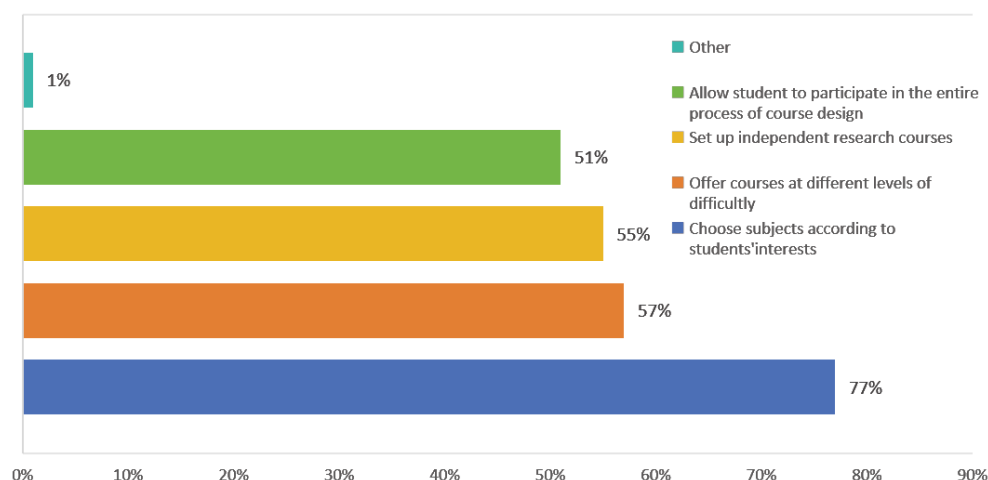


Figure 1. Students' choice of course setting method

Table 1. Analysis of learning mode data

X/Y	Look up the data by yourself	Ask students for advice	Ask the teacher for advice	Search for answers online	Give up searching for the answer	Subtotal
Further study at school	32 (88.89%)	23 (63.89%)	22 (61.11%)	24 (66.67%)	2 (5.56%)	36
Employment in relevant disciplines	21 (63.64%)	22 (66.67%)	19 (57.58%)	20 (60.61%)	2 (6.06%)	33
Employment in the direction of interest	15 (60%)	14 (56%)	15 (60%)	19 (76%)	4 (16%)	25
Other	4 (66.67%)	4 (66.67%)	1 (16.67%)	6 (100%)	0	6

2.2. Two Dimensions

Educational practice constitutes an integrative process combining knowledge impartation and holistic cultivation, emphasizing “comprehensive instructional dimensions and multidimensional talent development.” The pedagogical framework advocates extensive instructional dimensions encompassing teaching modalities, methodological approaches, theoretical foundations, technical competencies, and technological applications. This multidimensional architecture enables the efficient cultivation of students’ comprehensive qualities and capabilities, while the holistic developmental dimensions ensure optimized educational outcomes. The Practice Course’s core philosophy synthesizes three interdependent elements: rationalized instructional methodologies, diversified delivery mechanisms, and adaptive pedagogical frameworks, collectively designed to foster students’ holistic competencies and applied problem-solving capabilities.

Curriculum development adopts a problem-based learning (PBL) paradigm, specifically implementing PBL strategies to enhance deep learning and application competencies through authentic project execution. Emphasizing student-centered design, the course aligns all instructional activities with predetermined learning outcomes to ensure goal attainment. Throughout the learning process, instructors provide timely guidance and targeted instruction based on real-time student needs, maintaining continuous pedagogical engagement to stimulate proactive learning behaviors and enhance problem identification/resolution capacities^[5].

Simultaneously, pedagogical flexibility has emerged as a critical curriculum design principle. The traditional lecture-dominated model, where students passively receive information through auditory and visual channels, has been supplanted by an interactive paradigm. Instructors transition from knowledge transmitters to facilitators and cognitive coaches, integrating theoretical instruction with practical projects to prevent disorientation in self-directed learning environments. Students collaborate in research teams to complete engineering projects, followed by critical self-evaluations and peer assessments using structured rubrics. A comprehensive evaluation system monitors participation and performance, ensuring universal project engagement.

Furthermore, technological diversification significantly enhances instructional effectiveness. In the Automotive Design Practice Course, students employ CATIA—the industry-preeminent computer-aided design software—to materialize theoretical knowledge through digital modeling and feasibility analyses. Utilizing the Generative Structural Analysis (GSA) module, learners conduct static and modal analyses on transmission components, thereby deepening their understanding of engineering mechanics principles.

Educators must embody lifelong learning principles by continuously updating pedagogical knowledge and technical proficiency. This commitment enables the development of personalized instructional plans tailored to individual learning profiles and the continuous evolution of specialized curricula that emphasize customized educational pathways. Such approaches not only integrate theory with practice but also cultivate interdisciplinary competencies—for instance, synthesizing mechanical engineering and applied mechanics through computer-aided automotive design. Through collaborative project execution, students develop teamwork ethos, innovative thinking, and proactive problem-solving dispositions. Ultimately, this educational model cultivates new-generation engineering professionals with social responsibility, exemplary professional ethics, and innovative capacities, thereby fully realizing the dual objectives of comprehensive instructional dimensions and holistic talent development.

2.3. Three Levels

The evolving demands of modern society and industries have elevated expectations for graduates’

professional competencies and engineering literacy in higher education. To align with cutting-edge automotive industry developments, theoretical instruction and practical training must advance synergistically, ensuring comprehensive cultivation of students' innovative, creative, and entrepreneurial capabilities. This necessitates cultivating practice-oriented innovators tailored to employer requirements^[6], ultimately producing interdisciplinary engineering professionals meeting contemporary industry standards. The automotive practice curriculum adopts a three-tiered pedagogical framework: “interdisciplinary knowledge integration,” “industry-aligned skill development,” and “practical outcome orientation.”

2.3.1. Interdisciplinary knowledge integration

Contemporary engineering education increasingly emphasizes cross-disciplinary convergence, encouraging the synthesis of multidisciplinary knowledge domains. However, disciplinary integration in specialized automotive courses remains constrained by technological and methodological limitations. This instructional design bridges mechanical engineering, material science, and automotive systems through computer-aided methodologies, enabling theoretical knowledge transfer and cross-domain application.

2.3.2. Industry-aligned skill development

The curriculum implements a systematic workflow emphasizing holistic competency building. Students must demonstrate a comprehensive understanding of engineering projects—including component functionality, structural configurations, and operational principles—while attaining proficiency in parametric modeling and feasibility analysis using industry-standard tools. Through iterative design processes, learners internalize automotive engineering workflows and develop enterprise-ready technical skills.

2.3.3. Practical outcome orientation

Addressing the prevalent industry-academia competency gap, the curriculum incorporates market-driven requirements to enhance professional and engineering literacy. By integrating authentic industry challenges into coursework and fostering industry-academia partnerships, the program achieves practical outcome realization through three strategic dimensions:

- (1) Convergence of theoretical and applied learning.
- (2) Deepened industry-education collaboration.
- (3) Enhanced employability through innovation-centric training.

Centered on active learning and personalized development, this three-dimensional framework (“Knowledge Integration-Skill Cultivation-Outcome Realization”) synergizes academic knowledge transfer, industry-specific competency building, and practical innovation. It ultimately cultivates ethically grounded engineering professionals with robust technical expertise and creative problem-solving capacities, achieving dual advancement in pedagogical effectiveness and holistic talent development through deep integration of theoretical mastery and practical application.

3. Curriculum design

This course revolutionizes conventional pedagogical models by adopting a student-centered approach where instructors serve as cognitive facilitators^[7]. Through sustained dialogic engagement during project execution, the program cultivates advanced interdisciplinary engineering professionals equipped with independent critical thinking and engineering problem-solving capabilities.

3.1. Computer-aided design

The core of the practical course lies in comprehensively and systematically enhancing students' comprehensive competencies. To this end, the instructional design of the practical course requires deep integration of computer-aided analysis software as the practical carrier. By constructing virtual models through a virtual simulation platform, relatively two-dimensional theoretical knowledge is transformed into actionable project cases. This professional software-based practical teaching model not only strengthens students' technical operation proficiency but also cultivates their team collaboration skills and critical thinking through real-scenario teamwork.

3.2. Course objectives

The practical course of automotive design teaching is student-centered, integrating various teaching methods, starting from the needs of enterprises, in order to cultivate high-quality engineering talents needed by enterprises and provide strong support for the training of automotive professionals. The training objectives of this course are to master the main structure and body structure of automobiles, familiarize oneself with the working principles and coordination principles of various components of automobiles, learn the basic process of design and modeling, cultivate the ability to use computer software to solve problems, preliminarily master the CATIA software for automobile parts modeling and simulation modules, and be able to model and simulate basic automobile parts through static and modal simulation. After the course, students should be able to independently apply their professional knowledge, solve relevant problems in practical production or scientific research, and improve their ability to integrate theory with practice and innovation ^[8].

3.3. Course setup

Based on the course objectives, the teaching design process of this practical course is shown in **Figure 2**.

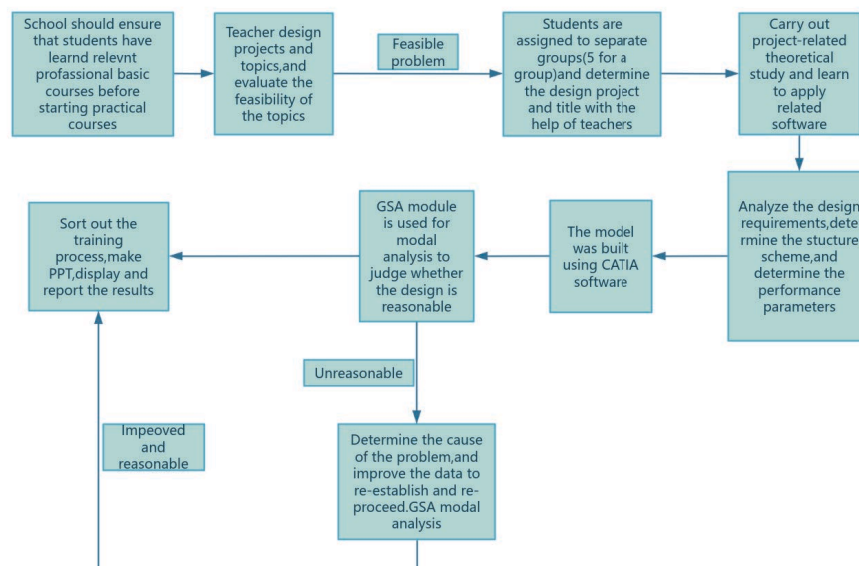


Figure 2. Teaching design process

The design duration of the teaching practice section is four weeks, including topic selection, teaching, practice, and achievement verification. Before conducting this practical course, the school should ensure that

the students in the class have completed professional basic courses such as automotive structure and automotive mechanical foundation, as well as the basic application of relevant computer design software. The course adopts a project-based learning model, where students independently form project teams and complete the entire development process from requirement analysis, scheme design to model production under the guidance of teachers. During the implementation process, a full process assessment mechanism is established. Teachers conduct comprehensive assessments by observing students' enthusiasm, project participation, and other situations. Through role rotation within the group, all members are ensured to deeply participate in key aspects. Finally, a three-dimensional evaluation system of "model display, process report, and defense statement" is used to focus on testing students' ability to use computer-aided tools for engineering expression. At the same time, a student group peer review section is set up to strengthen the cultivation of students' critical thinking.

The specific steps for conducting the course are as follows:

- (1) Distribution of the task book. In the first four class hours after the start of the course, a course design task book will be issued, and the teacher will explain the content of the task book. Students are required to independently search for relevant materials to deepen their understanding of the basic composition and working principles of automotive components; Understand the purpose of using computer design software; Students will be divided into groups of five to conduct modeling and simulation of an automotive component, and write a related engineering report at the end of the course.
- (2) Design of components. Select models for automotive components, use CATIA software to draw the components, and after drawing, submit them to other groups for mutual evaluation and to teachers to assess whether the component size settings are reasonable. After that, set the materials accordingly. Students should consult relevant literature on their own to strive for the rationality and professionalism of the component settings.
- (3) Simulation analysis of components. Apply the Generative Structural Analysis (GSA) module in CATIA software to perform static, modal, and other analyses on the model. Firstly, perform grid partitioning by subdividing the heavily stressed areas, reducing the grid size appropriately. Then, hide the grid and set constraints and distributed forces. By consulting relevant materials, set appropriate force points and constraint sizes, and calculate the simulation results. In this section, translational displacement vector analysis and equivalent stress analysis can be performed simultaneously.
- (4) Project acceptance and defense. The final 8 hours of the practical course will be used for project acceptance and group defense. The establishment of components, simulation, production of engineering reports, and presentation of defense PPTs are all scoring criteria; In the defense session, each group selects one student and teacher to form a defense group, which will ask project questions to each project group, including but not limited to the reasons for selecting components, problems in the design process, project division of labor, data in the engineering report, and professional knowledge learned.

4. Presentation of results

Taking the design and simulation of the solid shaft part of a new energy passenger vehicle transmission shaft done by a student project group as an example. **Figure 3** shows an example of a car transmission shaft.

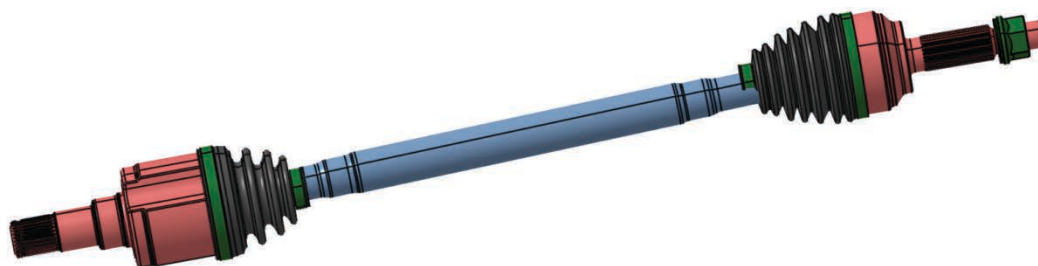


Figure 3. Automotive transmission shaft

4.1. Design phase

After studying basic theories and selecting topics with the assistance of teachers, students need to establish simulation models. As the core functional unit of the vehicle power transmission chain, the automotive transmission shaft system undertakes the dual mission of engine torque transmission and speed regulation. Among them, solid shaft components exhibit irreplaceable load-bearing advantages in the power transmission path due to their continuous, homogeneous cross-section structural characteristics. The student group designed the solid shaft part of the transmission shaft as shown in **Figure 4**.

Firstly, determine the input parameters of the car, as shown in **Table 2**.

Table 2. Parameters of transmission shaft

Input parameter	Power (P)	Rotating speed (n)	Shaft length (L)	Service environment
Value	120 kW	2000–3500 N·m	1.2 m	Room temperature, no corrosion

The commonly used materials for automotive transmission shafts are carbon steel, alloy steel, and stainless steel. The team designed a solid shaft for the transmission shaft of household economy cars, selecting 45 steel specified in the GB/T 699-2015 standard as the basic material with good comprehensive mechanical properties and low cost, and implementing quenching and tempering treatment process (850°C quenching + 600°C high-temperature tempering).

Calculation of transmission shaft torque:

$$T = 9550 \times \frac{P}{n} = 327.429\text{--}573 \text{ N} \cdot \text{m}$$

Compliant with the torque range of passenger cars (200–600 N·m).

Calculate the preliminary design shaft diameter based on the torsional strength formula. The formula for torsional stress is as follows:

$$\tau = \frac{T}{W_p} = \frac{16T}{\pi d^3}$$

Where W_p is the torsional section modulus, d is the shaft diameter, the allowable torsional stress standard of 45 steel modulation material is 120–160 MPa, and the shaft diameter is preliminarily designed as 30 mm by inversely pushing and rounding the formula.

The torsional angle formula is:

$$\theta = \frac{T \cdot L}{G \cdot J} \leq 0.108$$

Where L is the shaft length, G is the shear modulus (steel ≈ 80 GPa), J is the polar moment of inertia, and the allowable angle of twist is generally $\leq 0.25\text{--}1.0$ °/m.

Calculated values are within a reasonable range. The main purpose of this design is to let the higher vocational students learn the basic process of design modeling, train the ability to solve problems with computer software, and preliminarily master the modeling and simulation module of auto parts with CATIA software. Therefore, the analysis under different working conditions is not carried out in this study.



Figure 4. Solid shaft

4.2. Simulation analysis

The learning group adopts 45 steel as the basic material and implements the quenching and tempering process (850°C quenching + 600°C high temperature tempering). As shown in **Figure 5**, the solid axis is modeled by finite element analysis with a non-uniform grid division strategy, and the critical stress area is refined by local grid refinement technology to achieve a balance between calculation accuracy and efficiency. Fixed constraint and radial load boundary conditions are applied according to the basic working condition of the transmission shaft, and the specific loading scheme is shown in **Figure 6**.

The static analysis module based on the finite element method can effectively evaluate the mechanical response characteristics of mechanical components under multiple loads ^[9]. Based on the engineering practice of automobile transmission shaft bearing bending load in working process, the learning group applied a 1000 N uniformly distributed load on solid shaft under fixed constraint conditions, and the system acquired three key mechanical parameters: displacement field distribution, equivalent stress nephogram, and displacement vector field distribution (**Figure 7**). The equivalent effect force nephogram can directly reflect the potential failure area of the component, and the displacement vector field quantitatively characterizes the maximum deformation direction, which provides a theoretical basis for structural optimization.

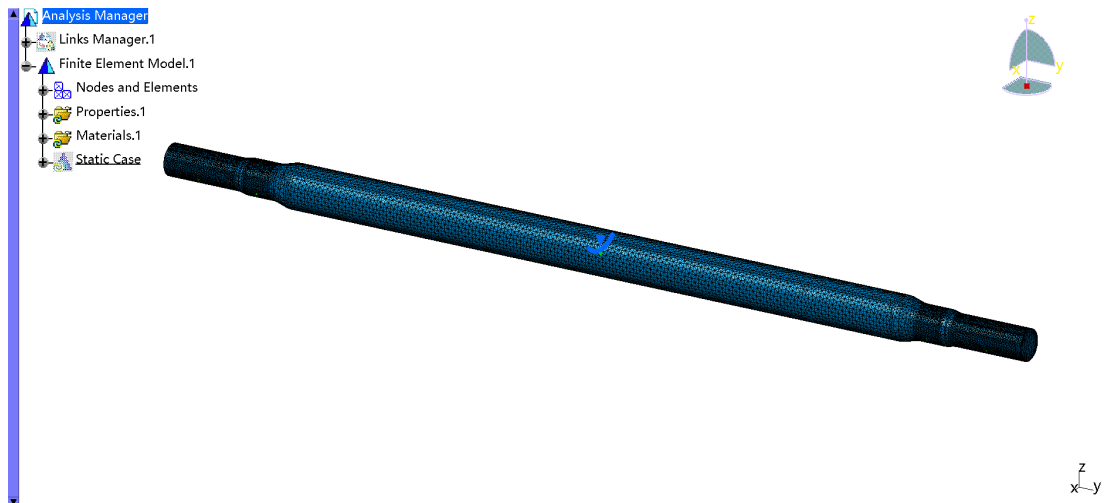


Figure 5. Grid division

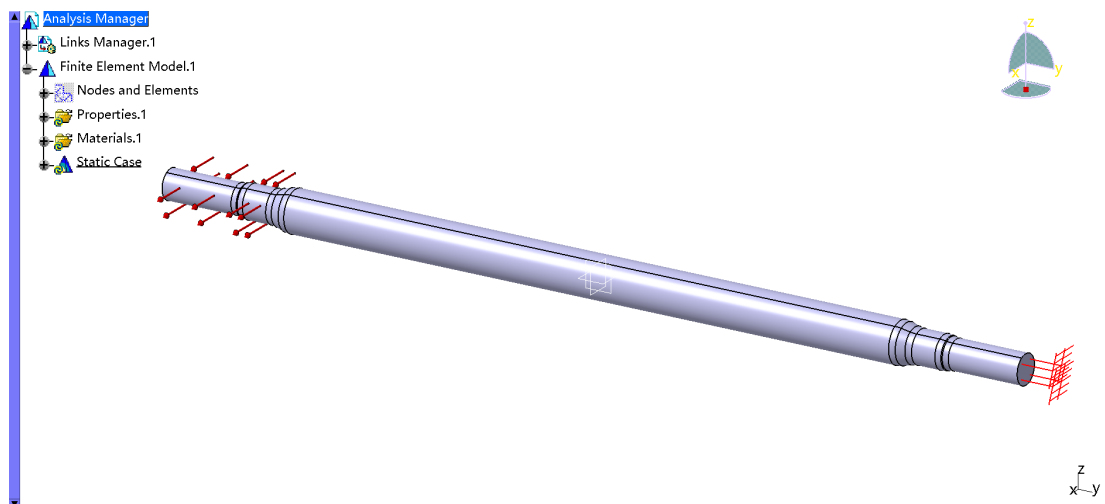


Figure 6. Load and restraint on solid shaft

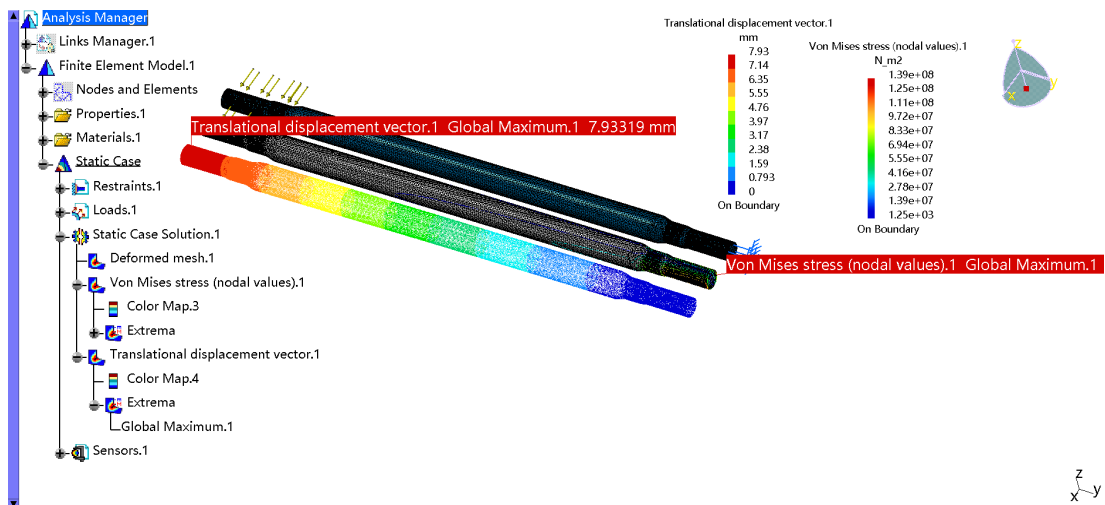


Figure 7. Graphical representation of static analysis

4.3. Analysis report

Basic parameters of the designed solid shaft are shown in **Table 3**.

Table 3. Basic parameters

Material	45 steel
Young's modules	$2 \times 10^{11} \text{ N/m}^2$
Poisson's ratio	0.266
Density	7860 kg/m^3
Coefficient of thermal expansion	$1.17 \times 10^{-5} \text{ K}^{-1}$
Yield strength	$2.5 \times 10^8 \text{ N/m}^2$

Based on the finite element calculation results (as shown in **Table 4**), the displacement constraint reaction of the key nodes of the transmission system presents significant non-uniform distribution characteristics. In the Tx (transverse translation) and Tz (axial translation) DOF directions, the maximum constraint reaction values $5.84 \times 10^5 \text{ N}$ (Tz direction) and $7.49 \times 10^5 \text{ N}$ (Tx direction) are detected at node 254907 respectively, and the spatial coordinates are concentrated in the (-14.77, -531.58, -14.38) mm. It is noted that node 252946 generates anomalous peak values of $9.34 \times 10^9 \text{ N}$ in the Ty (longitudinal translation) DOF direction, corresponding to spatial coordinates of (17.51, -568.64, -12.92) mm, which may be related to the stress concentration effect caused by local geometrical mutation.

Table 4. Limit hydroproject

Value (N)	DOF	Node	x (mm)	y (mm)	z (mm)
5.84×10^5	Tz	254907	-14.77	-5531.58	-14.38
9.34×10^9	Ty	252946	17.51	-568.64	-12.92

The statistical distribution characteristics of translational DOF (as shown in **Table 5**) show that the constrained reaction range is mainly concentrated in the range of 10^8 – 10^{10} N , accounting for 99.97%, of which the range of 10^9 – 10^{10} N accounts for 67.03%, confirming the effectiveness of the system load transmission path. The cumulative proportion of the low-order interval of 10 is less than 0.03%, which indicates that the structural redundancy of the secondary bearing area is reasonable. This bimodal distribution feature is consistent with the evaluation criterion of load distribution of mechanical systems in ISO 148-1:2016 standard, which verifies the accuracy of boundary condition setting and condition simulation of the finite element model.

Table 5. Translational DOF distribution

Value	Percentage (%)
10^5 – 10^6	2.62×10^{-4}
10^6 – 10^7	2.62×10^{-4}
10^7 – 10^8	1.07×10^{-3}
10^8 – 10^9	32.97
10^9 – 10^{10}	67.03

The results of the static analysis (as shown in **Table 6**) show that the mechanical balance requirements of Newton's third law are met in all DOF directions. In the axial (Fx) and torque (Mz) two main bearing directions, the applied load has a good numerical correlation with the restraint reaction: when the force is 1.0×10^3 N applied in the Fx direction, the system reaction is -1.0×10^3 N, the residual magnitude is 3.89×10^{-6} N, and the relative error is controlled at 4.90×10^{-9} magnitude; The constraint reaction torque corresponding to the torque load 6.38×10^2 N·m in Mz direction is -6.38×10^2 N·m, the residual converges to 2.18×10^{-6} N·m, and the relative error is lower than 3.66×10^{-9} , which fully verifies the rationality of boundary condition setting of the calculation model.

The residual force convergence values of non-main bearing directions (Fy and Fz) are less than 3.50×10^{-7} N, and the relative error magnitude is maintained within the range of 10^{-10} – 10^{-11} , meeting the residual convergence threshold requirements of ISO 10791-5 standard for static analysis of precision mechanical systems. For the bending moment component (Mx, My), the maximum residual moment is 1.96×10^{-9} N·m, and the numerical convergence index is better than the reference value of 1.0×10^{-6} N·m required by the engineering routine.

Table 6. Engineering report of static analysis

Components	Applied	Reaction force	Residual	Magnitude error
Fx (N)	1.0×10^3	-1.0×10^3	-3.89×10^{-6}	4.90×10^{-9}
Fy (N)	-5.67×10^{-8}	-2.87×10^{-7}	-3.43×10^{-7}	4.32×10^{-10}
Fz (N)	6.66×10^{-10}	4.10×10^{-8}	4.16×10^{-8}	5.24×10^{-11}
Mx (Nxm)	-5.55×10^{-10}	2.51×10^{-9}	1.96×10^{-9}	3.29×10^{-12}
My (Nxm)	-5.02×10^{-9}	1.37×10^{-8}	8.70×10^{-9}	1.46×10^{-11}
Mz (Nxm)	6.38×10^2	-6.38×10^2	-2.18×10^{-6}	3.66×10^{-9}

It is known from the finite element analysis engineering report that the relative amplitude error of each DOF direction is strictly controlled below 10^{-9} magnitude, and the convergence accuracy of 5.24×10^{-11} in Fz direction is very high. This data feature not only verifies the effectiveness of the mesh discretization scheme of the finite element model, but also verifies the rationality of the parameter setting of the iterative solver, providing reliable basic data support for the follow-up fatigue strength evaluation, evaluating the practicality of the parts designed by students, and verifying the realization of the objective of this practical course.

5. Effect evaluation and feedback

The establishment of the examination and evaluation system focuses on the comprehensive performance of students in multidisciplinary knowledge transfer, engineering problem modeling, innovation scheme design, unity and cooperation ability, etc., to ensure that the theoretical learning and practical application form a positive interaction loop. The evaluation of course setting includes collecting feedback from teachers and students, scientific evaluation of classroom effect and student performance by the teaching and research office, and further improvement and perfection of the course setting to make the practice course setting of automobile design more reasonable and effective.

5.1. Evaluation of students' practice results

In the last eight class hours, the teachers and students jointly accepted the team's achievements. The results were

accepted by means of an on-site simulation demonstration and PPT defense, and scored according to the form of assessment and evaluation. The practice course not only paid attention to the results, but also paid attention to student participation, teacher-student interaction, simulation design, etc. See **Table 7** for the evaluation table.

Table 7. Assessment form

Evaluation Form			
Scoring item	Total value	Marking criteria description	Score
Student engagement	15	Attendance, task commitment, workload	
Quality of teacher-student interaction	10	How well questions are raised/answered, how often you take the initiative to speak in class	
Teamwork ability	10	Ability of division of labor and coordination within the group, contribution to the team	
Problem-solving ability	15	Project resolution analysis ability, ability to handle emergencies	
Innovative thinking	15	Project innovation, program originality, interdisciplinary application ability	
Outcome design	15	Technical integrity, project completion, analytical reporting standards	
Presentation defense	10	Expression logic, PPT presentation effect, question answer	
Other bonus points	10	As team leader, project reporting member, etc., can be increased or decreased as appropriate	
Total value	100		

5.2. Feedback on teaching design

The teaching situation of the course in the graduating class of the automobile application and maintenance specialty shows that the seven project teams can complete the project well and reply smoothly. The integrity of the project report is high, and the comprehensive score of each student can reach more than 80. From the students' feedback, more than 90% of the students agreed with the course form, thinking that "I can learn a lot of useful things during the project," "I need to learn computer software to complete this project, and I also master a skill after the project is completed." The teacher of the graduating class feedback that "during the course, through my participation in the whole process, I observed that the practice course can let students learn together in communication and cooperation, and the students realize the importance of cooperation, but also cultivate the students' ability of organization and coordination."

6. Conclusion

The automobile design teaching practice course is a new teaching design course based on project learning, supported by CATIA, a leading design software in the automobile industry, and taking "one center," "two dimensions," and "three levels" as the teaching concept. It shifts the teaching focus from the teacher center to the student center, and shifts the previous teaching method focusing on conclusions and light process to a more conclusions and heavy process. In the practical course, one or more types of automobile parts are selected for modeling, static analysis, and generation of engineering reports. Finally, the results are jointly evaluated by the teachers and students to achieve the objective of cultivating interdisciplinary, high-quality

new engineering talents. Practical teaching is an important bridge for the transition of theoretical knowledge to actual production^[10]. Through the results of this course design, we see the possibility of implementing practical education in higher vocational schools, promoting the transformation of the engineering education mode to project teaching in higher vocational schools, and avoiding the situation of students “studying books”^[11]. In the modern society of industrialization, it is important for students to really master the skills required by enterprises and improve their ability to solve problems independently. The reform of comprehensive experimental teaching of engineering is a process with a long way to go and needs continuous exploration^[12]. As a part of the vocational education industry, the future needs to further optimize the curriculum, expand the scope of curriculum implementation, and lay a solid foundation for cultivating high-quality engineering talents for social development and industry needs.

Disclosure statement

The authors declare no conflict of interest.

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Research on Human-Computer Collaboration Paradigm in AIGC-Empowered High-Level Language Programming Courses

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Abstract: With the rapid development of artificial intelligence technology, AIGC (Artificial Intelligence-Generated Content) has triggered profound changes in the field of high-level language programming courses. This paper deeply explored the application principles, advantages, and limitations of AIGC in intelligent code generation, analyzed the new mode of human-computer collaboration in high-level language programming courses driven by AIGC, discussed the impact of human-computer collaboration on programming efficiency and code quality through practical case studies, and looks forward to future development trends. This research aims to provide theoretical and practical guidance for high-level language programming courses and promote innovative development of high-level language programming courses under the human-computer collaboration paradigm.

Keywords: Human-computer collaboration; AIGC; High-level language programming; Intelligence programming; Efficiency improvement

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1. Introduction

Under the wave of digital transformation, high-level language programming courses, as discipline requirement courses for students majoring in computer-related fields, have increasingly high requirements for efficiency and quality. In traditional courses, students have weak self-learning abilities and limited teacher resources, so traditional programming teaching is time-consuming and laborious, and is easily limited by students' programming experience and skills. Many researchers^[1-3] have proposed reform methods and measures for their respective courses, but the course effectiveness still cannot meet the ideal requirements. As a result, AIGC (Artificial Intelligence-Generated Content) technology^[4,5] has emerged, bringing new breakthroughs to support the development of university courses^[6] and attracting widespread attention from the industry. For example, research^[7,8] has provided methods for AI to assist university courses and improve teaching quality. Based on the above research inspiration, it holds great significance to study the AIGC-empowered intelligent code generation

and human-computer collaboration paradigm for high-level language programming courses, in order to improve programming efficiency, promote students' learning skills, and upgrade traditional courses.

2. Current status of high-level language programming courses

2.1. Course introduction

The high-level language programming course is a discipline requirement course for undergraduate students majoring in computer and information-related fields. This course relies on the C language for computer science initiation education, initially cultivates students' computational thinking ability, trains the basic methods and skills of program design, enables students to write programs to solve simple practical problems, and lays a solid foundation for solving complex engineering problems. While imparting knowledge, this course also trains students' hands-on ability, develops the ability to analyze and solve engineering problems, and emphasizes the cultivation of abilities and the development of individuality. The teaching contents are mainly covered by the following aspects: C language basic grammar, three basic program control structures, data organization structure, function, program organization structure, modular program design ideas and methods, first understanding of computer algorithms, and basic debugging skills of programs.

2.2. Existing problems

The summary of the current problems in high-level language programming courses is as follows:

- (1) Single teaching mode: In the past, high-level language programming classes mainly relied on teachers teaching knowledge points and students passively receiving learning knowledge points, supplemented by computer practice. This approach can easily make students feel tired of learning, and ultimately only learn paper skills without improving their hands-on abilities, resulting in students with "high scores but low abilities."
- (2) Weak self-learning ability of students: At present, most high-level language programming courses adopt a teaching mode of lecture-based and computer-based teaching, transmitting knowledge to students through classroom indoctrination, which results in a lack of improvement in students' self-learning ability. At the same time, in the specific process of computer programming, each student has various small problems and errors. Due to the large number of students and the limited time and energy of teachers, computer tutoring often cannot provide timely one-on-one answers to problems, leading to students easily feeling frustrated and losing interest in the course learning.
- (3) Simplified assessment and evaluation: At present, high-level language programming courses mainly focus on programming in terms of question types, with a small number of questions and a high proportion of scores for each question. Therefore, one assessment is not sufficient to measure students' learning ability, algorithm ability, engineering ability, etc.

3. Overview of AIGC technology

3.1. Definition and principles of AIGC

AIGC refers to Artificial Intelligence-Generated Content, which is based on deep learning generation models such as GPT and Codex, etc. By learning large amounts of text, code, and other data, AIGC captures patterns and features and generates new content based on input prompts or requirements. In code generation, after learning the code structure, syntax, and algorithms, the model can output corresponding code according to user

needs.

3.2. AIGC's advantages in assisting courses

The high-level language programming intelligent course empowered by AIGC can integrate emerging technologies such as artificial intelligence and big data, explore deep hybrid learning modes and continuous optimization and iteration methods of intelligent courses empowered by artificial intelligence, explore the application of artificial intelligence technology in course teaching, explore the method of transforming teaching mode from “teacher-student interaction” to “teacher-student-computer deep interaction,” and ultimately achieve efficient utilization of teaching resources, personalized learning experience for students, and high-quality teaching for teachers.

With the assistance of AIGC, it has the following advantages:

- (1) AIGC can quickly generate a large amount of code, shorten the development cycle, produce high-quality code, follow standards and best practices, have good readability and maintainability, and can implement complex functions, helping students overcome skill limitations.
- (2) On the basis of AIGC empowerment, a hybrid innovative teaching mode of “online self-learning + offline classroom interaction” can be easily formed. Teachers integrate and prepare materials through AI assistants, while students preview and learn independently from online resources through AI assistants. Based on each student's own situation, personalized AI learning support can be developed. At the same time, case analysis, group discussions, and programming practices can be combined with offline classroom to improve teaching effectiveness and learning efficiency.

3.3. Limitations of AIGC

Despite its obvious advantages, AIGC still has shortcomings, such as the possibility of logical errors in generated code that require manual inspection; Possible deviation in understanding complex requirements; Model training relies on a large amount of data, the quality and quantity of which affect the generation effect, and the model itself has high energy consumption and cost, etc.

4. Human-computer collaboration paradigm of high-level language programming courses empowered by AIGC

4.1. Construction of human-computer collaboration mode

The human-computer collaboration paradigm is based on AIGC tools as the machine foundation, combined with developer intelligence. Developers input requirements, AIGC generates a preliminary code draft, developers analyze and modify it, and use their creativity and domain knowledge to optimize the code. The collaborative process requires a good interaction mechanism, such as natural language processing for smooth communication between humans and computers, and version control systems for managing code iteration.

- (1) The advantages of human-computer collaboration: Human-computer collaboration combines machine efficiency and human intelligence to improve programming efficiency, ensure code quality, promote knowledge sharing and innovation, and drive the development of programming.
- (2) The challenge of human-computer collaboration: In collaboration, there are issues such as differences in understanding, vague definition of responsibilities, and excessive reliance on computers. It is necessary to balance the roles of humans and computers and optimize the collaboration mechanism.

4.2. Practical application of human-computer collaboration

Under the empowerment of AIGC, the high-level language programming course can achieve the following capacities:

- (1) Intelligent lesson preparation: Using AI assistants such as KIMI, DeepSeek, ChatGPT, etc., automatically generate teaching plans, courseware, exercises, and other teaching resources based on teaching objectives, existing teaching materials, and student situations.
- (2) Intelligent tutor: In programming education, AIGC can generate example code, explain knowledge points, correct homework, assist teachers in teaching, and enhance students' practical abilities. At the same time, teachers can train AI teaching assistants to provide real-time answers to students' questions, offer learning advice and guidance, perform automatic code evaluation and code correction functions, and reduce the burden on teachers.
- (3) Intelligent code function: AIGC tools such as GitHub Copilot can complete code in real-time, improve input efficiency, and automatically fix syntax errors to ensure code standardization. At the same time, AIGC tools can automatically generate code frameworks and complete programs based on functional requirements, optimize existing code, and improve performance and readability.
- (4) Intelligent learning path planning: Based on the different foundations and learning needs of each student, develop personalized learning paths, provide targeted learning resources and guidance, and help students learn more effectively.
- (5) Intelligent homework system: Based on an intelligent homework system, it can monitor students' learning progress and situation at any time, automatically evaluate and assist in correcting homework codes in real time, provide personalized learning advice and guidance for students, and timely solve problems encountered by students in the learning process.

4.3. Impact of human-computer collaboration

Through preliminary practice of human-computer interaction, it has been proven that various impacts can be improved as follows:

- (1) Teaching efficiency improvement: By optimizing teaching through AIGC technology, teaching efficiency has been significantly improved. For example, preliminary teaching data shows that students' mastery of knowledge points has increased by about 30% compared to traditional teaching, and classroom interaction and fun have also been enhanced.
- (2) Learning outcomes improvement: With the assistance of AIGC, the average score of students' programming ability has been improved to a certain extent, and the conversion rate of high-risk warning students has also been improved, fully reflecting the advantages of AIGC in improving teaching quality.
- (3) Programming efficiency improvement: Through preliminary practice, compare traditional manual programming, pure AIGC programming, and human-computer collaborative programming. The results show that the human-computer collaboration group has the highest efficiency and significantly reduces development time, which proves its advantage in improving programming efficiency.
- (4) Code quality assurance: Preliminary practical results show that collaborative group code quality is also better, with lower error rates, good readability and maintainability, reflecting the effectiveness of human-computer collaboration in ensuring code quality.

5. Conclusion

The new paradigm of human-computer collaboration in AIGC-empowered high-level language programming, integrating machine efficiency and human intelligence, can improve programming efficiency and teaching quality, cultivate students' independent learning and thinking abilities, and has broad application prospects. In the future, we need to continue exploring collaborative mechanisms, overcome technical challenges, ensure the steady development of AIGC, and help steadily improve the effectiveness of curriculum education.

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The Teaching Reform and Practice of Professional Courses for Engineering Students

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Abstract: Higher education is at the top of the educational hierarchy. With the booming development of the economy and society in China, its scale is also expanding greatly. Professional course teaching is a key component of higher education, and it plays a vital role in cultivating professionalism and even the overall level of students. According to several problems existing in the current teaching practice of professional courses at our universities, in order to improve the teaching quality to meet the requirements in the emerging engineering era, related strategies and approaches for teaching reform are proposed as follows. Firstly, we advance the traditional classroom teaching into the modern one with equal double-subjects of teachers and students to cultivate the active and comprehensive learning ability of students. Secondly, the scientific research practice-oriented teaching method is introduced, and it contributes to connecting theory with engineering practice for students. Thirdly, the diversified course assessment system is explored, and a closed-loop quality control strategy is discussed on the basis of a questionnaire survey and face-to-face interview. By questionnaires and final assessments, it is clear that teaching qualities of related professional courses are satisfactory in recent years, and the methods and strategies can be widely applied to the teaching practice of other courses.

Keywords: Teaching reform; Professional courses; Engineering; Teaching mode; Higher education

Online publication: May 28, 2025

1. Introduction

Currently, with the national economic prosperity and social progress, high-caliber talents in our country are in urgent demand, promoting the development of higher education. As universities bear the key responsibilities for shaping skilled professionals, it is now been an urgent task for them to cultivate large groups of innovative as well as entrepreneurial talents to adapt to today's rapid social development ^[1,2].

Since undergraduate enrollments began expanding thirty years ago, there has also been a substantial growth in graduate education lately. China has no doubt grown into the largest scale of university students around the globe. However, the contradiction between cultivating quality and cultivating quantity is also increasingly prominent ^[3]. At present, along with the rapid development of modern science and technology, higher and more comprehensive

requirements for the quality of higher education have been put forward compared to previous standards^[4]. Professional course teaching is the cornerstone of the entire cultivating systems at universities^[5,6]. Therefore, it is of great significance to explore the proper teaching mode and methods, which are suitable for the real national and school conditions, as well as help to guarantee and improve the teaching quality of professional courses. Related strategies and approaches can also be applied to the teaching process of other corresponding courses.

2. Current issues in professional course teaching

Based on our practice, the following typical issues can be summarized during the teaching process of engineering professional courses.

2.1. How to ensure teaching quality in the face of reduced teaching hours

For many engineering majors, with the rapid development of new disciplines such as Big Data and Artificial Intelligence, courses combined with new technologies and methods are emerging rapidly in major cultivation programs. It results in the trends of professional courses along the direction of more diversification and fewer teaching hours. However, the general requirements for students in the syllabi have not decreased, and even increased with the development of new technologies, which also means that the learning difficulty of related courses for students has increased. Therefore, there is a contradiction between the reduction of teaching hours and the guarantee of teaching quality.

2.2. How to handle the relationship between teachers and students in classroom teaching properly

Based on the abundant and convenient learning resources on the Internet, many students are not ignorant of the course contents. However, there still largely exist traditional cramming teaching methods at our universities at present. This is extremely detrimental to the cultivation of innovative and creative thinking, independent learning, and practical ability of college students. Therefore, it is necessary to dilute the dominance of teachers and promote the status of students in classroom teaching, so that it will gradually evolve into a mutually beneficial relationship between these two subjects in classrooms. In other words, it is essential to really invite students into classrooms and improve their enthusiasm and initiative in learning.

2.3. How to combine classroom teaching with scientific research practice

For many engineering courses, curriculum theories and engineering practice are inseparable. However, in the current teaching practice, there is a general phenomenon of separation between these two aspects. Instructors tend to emphasize theories over practice in classroom teaching. The so-called “linking theory with practice” is mostly just adding a few verification experiments. This kind of teaching is not convenient for students to understand and master the theoretical knowledge of the courses in a comprehensive and systematic way, and it is also unhelpful to cultivate their ability in innovative scientific research and practice. Therefore, how to combine theoretical knowledge of the courses with scientific research practice is one of the key issues related to cultivating compound talents with strong innovation and practical abilities.

2.4. How to assess grades and construct teaching quality control systems scientifically

At present, there are many subjective and arbitrary elements in the assessment of professional course grades. Most of the final grades come from final exams or papers, and the usual performance grades are only evaluated

by course assignments or even class attendance. Scientific, objective, and comprehensive grade assessments can effectively stimulate the learning enthusiasm and initiative of students. In addition, the construction of closed-loop control systems for teaching quality control has received wide attention in educational circles nowadays^[7,8]. However, how to construct the key feedback mechanisms in the above systems and make them operable is a question worth exploring in detail.

3. Methods and realization of teaching reform in professional courses

In contrast to traditional teaching techniques, the reformed approaches could make a good combination between in-class education and off-class self-study, as well as theoretical studies and scientific research practice. After classroom discussion among students, students and teachers analyze and explore the ways to solve various problems to help students acquire knowledge, obtain experience, and master the basic principles of professional courses more deeply. The specific contents of our reform approaches and practice can be elaborated as follows.

3.1. Transformation from traditional classroom teaching to double-subject teaching mode

In view of the fact that most of professional courses are offered to senior college students, who have already mastered the basis of professional theoretical knowledge of their own majors, and most engineering professional courses are oriented to the practical engineering applications, it is particularly well-suited for students to engage in presentation as well as discussion, and therefore master the course through self-study, group study, and discussion with teachers. Only by this means could the class be transferred from the traditional one-way teaching into a double-subject mode, which benefits the cultivation of students' comprehensive learning capabilities.

During each chapter's classroom instruction, teachers would first give the introduction, basic knowledge, and methodologies, then give the engineering applications as well as case studies, allowing students to choose according to their knowledge interest. Students could group themselves as they pleased. Through self-learning, group learning, and online and face-to-face meetings with teachers, they could dig into textbooks, search for scholarly works, or carry out research outside of class. Students are also required to give presentations in class with PowerPoint to declare general concepts, implement approaches, and provide solutions. After the presentation, there would be several minutes for the students to discuss and for the teachers to direct generally and answer the questions. Lastly, there would be peer reviews for students to evaluate the presenting groups or students.

When a course ends, several paper topics about the course are listed for students to pick. Those papers would require literature reviewing, material searching, data gathering, as well as question analyzing skills. Papers would be turned in at the end of a course, fully leveraging the edges of the dual-subject teaching mode, turning the students into the leading role in the procedure, as demonstrated in Figure 1.

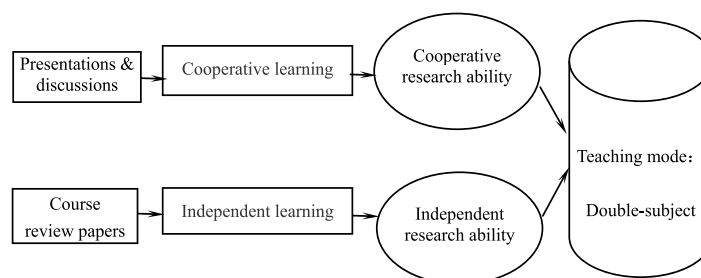


Figure 1. Diagram of dual-subject teaching mode

3.2. Scientific research practice-oriented teaching method

Most of professional course teachers have been engaged in research on course-related fields for decades. By combining students' research interests with various kinds of research projects undertaken by teachers, self-learning, research-oriented, and practical research-discussion based teaching could be conducted. Meanwhile, school-distinctive curriculum knowledge in the application of sea porting and shipping could be enhanced to improve students' interests and engagements, promoting their comprehensive understanding in the theoretical frameworks and engineering practices.

Specifically, combined with teachers' scientific research projects and engineering practice, as well as the characteristics of our universities, a special designing case base on engineering applications is designed for professional courses, which includes many practical design problems related to the courses. In the late stage of course teaching, students have almost mastered the fundamentals of the curriculum theory and methodology. Then, let them choose their own practical problems from above case base based on their interests, conduct literature retrieval, establish mathematical models according to engineering data provided by the case base, solve these models by methods learned in course teaching, as well as analyze and sort out the obtained results. Finally, complete curriculum design reports are requested to be written, which can be recorded as part of the course final assessments. At the same time, students are encouraged to enrich and improve the relevant research in the design reports for publishing papers or applying for patents.

All of these can not only help students to utilize the course theoretical knowledge in practice, but also further improve students' ability to make full use of their professional expertise to carry out project research and solve real engineering problems, as well as stimulate students' interests in autonomous learning and scientific research practice.

3.3. Diversified assessments and closed-loop teaching quality control system

Research-practice-oriented, teacher-student dual-subject teaching methods should be validated through an unbiased and objective course assessment system. Such a system could help students to consistently apply their effort throughout the semester instead of relying on the last minute before the final exams.

Thanks to the teaching reform, students' grade is now comprehensively assessed based on course reviewing paper that takes up for approximately 20% of total score; classroom PPT presentation and discussion that takes up for approximately 30%; course project design report that takes up for approximately 20%; and the final exam that takes up for about 30%. Such an evaluation system largely prevented rote study and encouraged free research.

More specifically, the quality of the reviewing papers and course project design reports would be evaluated from the dimensions of innovation, difficulties, and quality of the content, attitudes, and formatting. The PowerPoint would be estimated by the Delphi Method ^[9], incorporating assessments from three parts: teacher assessment accounting for 60%, self-assessment accounting for 20%, and peer assessment accounting for 20%. For the final examination, the score would be determined by the model answer.

Additionally, in terms of the presentation section, teachers would merely estimate from students' preparation, oral presentation, as well as the afterwards questioning and discussions. The designed grading chat would give self-estimation and peer estimation. The grading chat aims for four main sections: the questioning ability, the problem-solving ability, teamwork, and expression. Several secondary indicators are designed for the four sections above.

Therefore, the final grades of the students are fair, objective, and diverse. Scores from all sections that are mentioned above formed the final grade, which also provides teachers and educators with an objective final achievement of the course.

At the end of each curriculum, teachers would distribute questionnaires directly in class or online. They would also conduct interviews with student representatives. The results of those questionnaires and feedback from the interviews would be submitted to the teachers and the educating group together with the final score. Those in general would build a closed-loop educating quality control system and boost the continuous upgrade of the course, as shown in Figure 2.

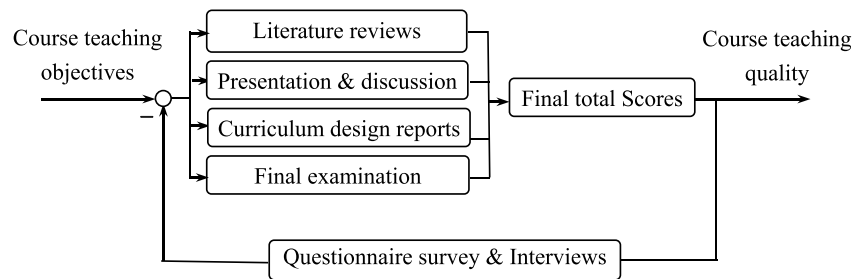


Figure 2. The closed-loop teaching quality control system with feedback from questionnaire surveys and interviews

4. Conclusion

With the rapid development of national economy and society, under the background of higher and more comprehensive requirements proposed for cultivating quality of all kinds of students at universities, based on our teaching practice, we put forward relevant teaching reform approaches and strategies in view of several problems existing in the teaching of professional courses for engineering students. The main contents include promoting the development of classroom teaching mode with equal double subjects of teachers and students, carrying out scientific research practice-oriented teaching method, as well as constructing diversified assessment mechanisms and a closed-loop teaching quality control system. In the past five years, i.e., from 2020 to 2024, the average scores of six professional courses taught by authors are all over 70 points. According to the past five years' questionnaires, the proportion of students who were “very satisfied” or “satisfied” with the courses was over 80%. The satisfaction ratios are stable and have increasing trends year by year. None of the students chose “dissatisfied”, and the rest of them chose “basically satisfied.” We have received three province-class and six school-class education reform projects, and two professional courses were awarded Provincial First-class courses.

From the above data and awards, it is clear that the teaching reform approaches and measures have made certain achievements in practice. They can effectively stimulate students to devote to creative learning and scientific research, as well as strengthen the combination of course theoretical knowledge and scientific research practice. All of these are more conducive to the cultivation of all-round qualified talents. The relevant measures and methods can be widely applied to other professional courses, which are also expected to provide inspiration and reference for the teaching reform of compulsory courses for engineering students.

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Evaluation of the Effect of Integrating the Craftsman Spirit into Mechanical Professional Courses: A Follow-Up Study for One Academic Year

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Abstract: With the accelerating process of transformation and upgrading of China's manufacturing industry, employers' requirements for the professional qualities and skills of technical workers are increasing day by day. As the core value to promote high-quality development, the craftsman spirit has become an important part of vocational education. Taking the Mechanical Foundation course of the mechanical major in a technician college as an example, this study tracked and analyzed the teaching effect of integrating the craftsman spirit into the course for one academic year. By comparing the performance of students before and after integrating the craftsman spirit into daily teaching, it explored its influence on students' professional skills, innovation ability, and professional qualities. The study collected data through questionnaires, classroom observations, etc., providing a practical basis for the promotion of the craftsman spirit in vocational education and curriculum reform in the future.

Keywords: Craftsman spirit; Mechanical professional teaching; Vocational education

Online publication: May 28, 2025

1. Introduction

In recent years, the craftsman spirit has received more and more extensive attention. It emphasizes the ultimate pursuit of craftsmanship and strict requirements for quality, as well as personal responsibility, concentration, innovation, and the unrelenting pursuit of excellence. Scholars at home and abroad have conducted extensive research on the craftsman spirit. Xue put forward two core connotations of "valuing skills" and "upholding morality"^[1]. Deng *et al.* further refined the contemporary connotation of the craftsman spirit into "craftsman's heart," "craftsman's action," and "craftsman's quality"^[2]. Although the importance of integrating the craftsman spirit into daily teaching has been widely recognized, there are still many problems in the actual teaching process. A sampling survey of vocational schools in the Yangtze River Delta region by Gao and Deng found

that the recognition of the craftsman spirit among teachers and students has increased, but there is still a lack of a systematic plan for cultivating the craftsman spirit^[3]. Through a questionnaire survey, Du pointed out that the cultivation of the craftsman spirit in teaching is separated from students' learning of knowledge and skills, and there is also a lack of in-depth guidance on the craftsman spirit during the internship and training stage^[4].

Based on the above theoretical discussion of the craftsmanship spirit and existing research results, this paper will conduct an in-depth study on the integration effect of the "craftsmanship spirit" in mechanical professional courses. Through a one-year follow-up survey and data analysis of two classes, it will evaluate the specific impact of the integration of the craftsmanship spirit on students' professional skills, professional qualities, and comprehensive qualities.

2. Theoretical basis: Developmental research evaluation theory

This study will adopt the developmental evaluation theory as the main theoretical support to evaluate the integration effect of the craftsmanship spirit in mechanical professional courses. The developmental evaluation theory emphasizes the dynamic changes in the educational process, especially focusing on the long-term growth and improvement of learners' comprehensive abilities. Within this framework, evaluation not only focuses on students' current knowledge mastery but also emphasizes their continuous progress, behavioral changes, and skill development^[5].

A longitudinal design tracked students across two semesters, evaluating three dimensions:

- (1) Cognition: Evolving understanding from technical skills to professional ethics.
- (2) Emotion: Value identification with excellence and innovation.
- (3) Behavior: Practical application in tasks and quality standards.

The study employed a longitudinal design where baseline measurements (questionnaires and academic performance) were collected during Semester 1's traditional instruction, followed by systematic craftsman spirit integration in Semester 2 with repeated assessments, enabling analysis of both the temporal development of professional competencies and the relationship between spiritual cultivation and technical skill acquisition.

3. Research materials: Questionnaire survey and grade analysis

The study tracked two classes (2023 Industrial Robot and Electronic Technology Application majors) for one year to assess craftsman spirit integration in mechanical courses. Data collection included: (1) a self-developed questionnaire measuring cognition, emotion, and behavior, administered at each semester's start and end; (2) analysis of "Fundamentals of Machinery" final exam scores; and (3) implementation of craftsman spirit-integrated teaching with practical activities in Semester 2.

3.1. Strategies for integrating the craftsmanship spirit

The study implemented a comparative approach across two semesters in the "Fundamentals of Machinery" course. During the first semester, conventional teaching methods were employed without explicit integration of craftsman spirit elements. In the second semester, instructors systematically incorporated craftsman spirit concepts using Tang's curriculum design framework^[6], developing chapter-specific teaching plans that blended technical content with relevant case studies and practical activities. For instance, in the "Gear Transmission" unit, students engaged with precision engineering applications while developing professional values through hands-on design tasks and case analyses, effectively merging technical skill development with craftsman

spirit cultivation. **Table 1** shows the teaching case design for integrating the craftsmanship spirit into the gear transmission chapter.

Table 1. Curriculum content design under the concept of craftsmanship spirit

Course content	Cultivation points of craftsmanship spirit	Practical activities
Overview of gear transmission	Dedication and love for work: Understand the application and importance of gear transmission and cultivate a love for the mechanical major	Consult information and make a PPT presentation on gear transmission application cases
Geometric parameters and calculation of gears	Striving for excellence: Accurately calculate gear parameters to ensure design accuracy	Manually calculate parameters such as the module and number of teeth of gears and compare them with the standard answers
Design of gear transmission system	Innovative thinking: Design a gear transmission system to optimize transmission efficiency	Design a small-scale gear transmission system and conduct simulation analysis
Optimization of gear transmission system	Continuous improvement: Optimize the design	Optimize the designed gear transmission system

3.2. Research results: Evaluation of the cultivation effect of craftsman spirit

The study assessed students’ performance across four key dimensions of craftsman spirit development: cognitive understanding, emotional engagement, behavioral application, and overall composite scores. These measurements were obtained through pre- and post-intervention questionnaires, with statistical analysis comparing mean values, standard deviations, and significance levels between the two testing periods. The results demonstrated measurable changes in all dimensions following the educational intervention.

As can be seen from **Table 2**, the comparative analysis revealed consistent improvements across all measured dimensions. Cognitive scores showed the most significant increase (16.72 to 19.74), demonstrating the intervention’s effectiveness in enhancing understanding of craftsmanship principles. Emotional engagement scores rose moderately (18.88 to 19.97), while behavioral application showed modest gains (18.96 to 19.94). The composite score increased from 56.74 to 60.50 ($P < 0.05$), confirming the overall positive impact of the pedagogical approach on craftsmanship spirit cultivation.

Table 2. Data table comparing the mean values of each dimension in two surveys on the cognition of the craftsman spirit

	First-time average	First-time standard deviation	Second-time average	Second-time standard deviation	<i>t</i> statistic (<i>t</i> -stat)	<i>P</i> value (<i>P</i> -val)
Cognition	16.72	4.06	19.74	5.38	-4.478	1.27×10^{-5}
Emotion	18.88	4.61	19.97	4.11	-1.77	5.10×10^{-5}
Behavior	18.96	5.01	19.94	4.06	-1.52	2.43×10^{-5}
Total score	56.74	8.60	60.50	7.59	-3.28	2.82×10^{-5}

The analysis of final exam results revealed significant academic improvements following the teaching intervention (**Table 3**). The average score increased substantially from 57.44 to 66.66 ($P < 0.001$), while the median rose from 59.55 to 66.65, demonstrating widespread gains across the student cohort. Although maximum scores showed more modest improvement (78.77 to 88.8) and the standard deviation remained stable (10.13 to 10.30), these patterns collectively confirm the intervention’s effectiveness while suggesting potential

variations in impact across different achievement levels that merit further investigation.

Table 3. Data analysis table of the two final exam results

	Average	Median	Maximum	Standard deviation	<i>t</i> statistic (<i>t</i> -stat)	<i>P</i> value (<i>P</i> -val)
Final exam of the first semester	57.44	59.55	78.77	10.13	-	-
Final exam of the second semester	66.66	66.65	88.8	10.30	-6.75	1.04×10^{-9}

To better understand these differential effects, the study employed Pearson correlation analysis to examine the relative contributions of cognitive, emotional, and behavioral dimensions to craftsmanship development, as shown in **Table 4** ^[7]. This methodological approach provided empirical evidence for optimizing teaching strategies by identifying which aspects of craftsmanship spirit cultivation most strongly influenced academic outcomes.

Table 4. Pearson coefficient table of the correlation between final exam results and the three dimensions of craftsmanship spirit

	Cognition	Emotion	Behavior
Score of the first final exam	0.314	0.529	0.468
Score of the second final exam	0.229	0.595	0.448

Pearson correlation analysis revealed distinct patterns in how cognitive, emotional, and behavioral dimensions influenced exam performance. The emotional dimension showed the strongest association with academic achievement, with coefficients increasing from 0.529 to 0.595 after the intervention, suggesting enhanced motivational effects. Cognitive correlations decreased slightly (0.314 to 0.229), possibly reflecting a shift toward more comprehensive skill application. Behavioral impacts remained stable (0.468 to 0.448), indicating consistent but gradual skill internalization. These findings demonstrate that while emotional engagement became the primary academic driver post-intervention, all three dimensions contributed uniquely to craftsmanship development, with cognitive understanding providing foundational knowledge and behavioral practice enabling long-term skill mastery.

4. Conclusion and outlook

This study demonstrated that integrating craftsmanship spirit into mechanical courses significantly enhanced students' cognitive understanding and emotional engagement. The emotional dimension showed the strongest correlation with academic performance ($r = 0.595$), highlighting the importance of motivation and participation. While cognitive improvements primarily strengthened knowledge foundations, behavioral changes exhibited gradual but sustained development. These findings validate craftsmanship education's dual role in enhancing both professional competencies and vocational qualities. Future research should examine the model's applicability across disciplines and its long-term effects, as these results position craftsmanship spirit as a vital component in cultivating high-quality technical professionals.

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Disclosure statement

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Exploration of Teaching Practice on Empowering the Consciousness of the Chinese National Community with Ethnic Music in Universities in Border Areas

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Abstract: Against the strategic backdrop of forging and strengthening the consciousness of the Chinese national community in the new era, universities in border areas, as crucial platforms for the integration of multi-ethnic cultures, shoulder the significant mission of enhancing ethnic unity and promoting outstanding traditional Chinese culture. As an important carrier of Chinese culture, ethnic music not only contains profound historical memories and emotional identities but also demonstrates a powerful cultural and educational function in the teaching of border universities. Based on the actual situation of universities in border areas, this paper analyzes the unique value of ethnic music in cultivating students' national identity, cultural identity, and emotional identity, and explores effective paths for it to empower the forging and strengthening of the consciousness of the Chinese national community in teaching practice. By combining policy orientations and teaching status quo, the paper points out the main dilemmas such as single curriculum content, insufficient integration of ideological and political education, and a lack of practical resources, and proposes countermeasures such as strengthening the integration of ideological and political education, optimizing the curriculum structure, and expanding practical platforms. Through the deepening and innovation of ethnic music education, border universities can effectively enhance students' cultural consciousness and cultural confidence, providing solid educational support for forging and strengthening the consciousness of the Chinese national community. This paper has positive significance for promoting the high-quality development of education in border universities and constructing a new-era ethnic unity and progress education system.

Keywords: Border universities; Ethnic music; Consciousness of the Chinese national community; Teaching practice; Cultural identity

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1. Introduction

Forging and strengthening the consciousness of the Chinese national community is an important strategic task of socialism with Chinese characteristics in the new era. Especially for border areas, it has far-reaching political and practical significance. As the main front for cultivating people with moral integrity, universities shoulder the important mission of training new-era talents for national rejuvenation. Universities in border areas, located at the forefront of ethnic integration, face a complex pattern of co-existing multi-ethnic and multi-cultural groups. Their educational function is not only to impart academic knowledge but also to carry the important responsibility of enhancing ethnic unity and strengthening national identity. Against this background, ethnic music, as an important carrier of outstanding traditional Chinese culture, with its rich historical deposits, strong emotional expressions, and unique cultural symbols, plays an irreplaceable role in strengthening cultural identity, promoting ethnic integration, and carrying forward the national spirit.

In recent years, the state has attached great importance to the role and path expansion of ethnic music in higher education. In the reply to Proposal No. 2112 of the Third Session of the 13th National Committee of the Chinese People's Political Consultative Conference, the Ministry of Education clearly pointed out that courses such as ethnic musicology and traditional Chinese music should be systematically incorporated into the university talent training system to strengthen young students' understanding and recognition of the multi-ethnic culture of China and enhance cultural confidence. At the same time, the National Press and Publication Administration issued the "Notice on the High-quality Publication Projects of the Chinese Ethnic Music Inheritance and Publication Project," proposing to carry forward outstanding traditional Chinese culture and showcase the contemporary elegance of ethnic music by deeply exploring, sorting out, and publishing high-quality ethnic music projects, further promoting the cohesion and dissemination of the consciousness of the Chinese national community.

While the policy level is constantly advancing, universities across the country have responded positively, carrying out curriculum construction and teaching practices with regional characteristics. Universities in border areas are at the forefront. For example, universities in Guangxi, Xinjiang, Yunnan, and other places have actively integrated local ethnic minority music resources into the teaching practice of curriculum-based ideological and political education. Through the establishment of ethnic music courses, they guide students to understand the integration of multi-ethnic cultures and the historical logic of national unity, thereby enhancing cultural identity and a sense of responsibility. Based on this, it has important theoretical and practical value to explore how ethnic music education in border universities can more effectively serve the forging and strengthening of the consciousness of the Chinese national community. This paper will combine the actual situation of universities in border areas, analyze the unique role and practical dilemmas of ethnic music in consciousness cultivation, and propose optimized teaching paths to promote the integrated development of ideological and political education, aesthetic education, and ethnic unity education.

2. The unique value of ethnic music in forging and strengthening the consciousness of the Chinese national community

2.1. The cultural carrier function of ethnic music

The General Secretary pointed out in his speech at the National Ethnic Unity and Progress Commendation Conference in 2024 that "the splendid Chinese culture is jointly created by all ethnic groups. To create a new glory of socialist culture, we must constantly strengthen our identification with Chinese culture and promote the mutual learning and integration of the cultures of all ethnic groups"^[1]. Cultural identity is a socialized,

practical process. The cognitive and internalization process of all ethnic groups in China towards Chinese culture constructs the cultural consciousness of the value, concept, and consciousness system of Chinese civilization ^[2]. As a tangible carrier of culture, ethnic music not only records the lifestyles, religious beliefs, social systems, and aesthetic orientations of all ethnic groups but also continuously strengthens the common cultural genes in intergenerational inheritance. Through the interpretation of melodies, rhythms, and lyrics, ethnic music vividly reproduces the cultural characteristics of the pluralistic and integrated Chinese ethnic groups, becoming an important link in maintaining cultural identity with Chinese culture ^[3]. Ethnic music plays an irreplaceable role in transmitting traditional values, carrying forward the national spirit, and maintaining the continuity of ethnic culture. Through systematic ethnic music education, universities can help students deepen their understanding of the historical development of the Chinese nation and enhance their awareness of the pluralistic and integrated pattern of the Chinese nation, thus laying a solid cultural foundation for forging and strengthening the consciousness of the Chinese national community.

2.2. The role of ethnic music in emotional identity and value identity

As an art form with strong emotional expressiveness, ethnic music can directly stimulate individual emotional resonance and promote the formation of emotional identity and value identity. The consciousness of the Chinese national community, as the most real and universal emotional identity and psychological cognition, demonstrates the common psychological characteristics of all ethnic groups in China ^[4]. In the process of singing and appreciating ethnic music, students can perceive the hardships and glories of ethnic history through artistic experiences and feel the emotional context of the common struggle and development of multiple ethnic groups. This immersive cultural experience helps to break down regional differences and ethnic group barriers and enhance students' deep understanding of the Chinese nation as a community with a shared future. At the same time, the values such as patriotism, heroism, and collectivism contained in ethnic music subtly guide students to form positive value pursuits, thus deepening their identification with the consciousness of the Chinese national community at both the emotional and rational levels.

2.3. The shaping of cultural confidence of young students by ethnic music

Cultural confidence is a more fundamental, extensive, and profound form of confidence. As the backbone of the great rejuvenation of the Chinese nation, the cultivation of cultural confidence among young students has strategic significance for forging and strengthening the consciousness of the Chinese national community. With its profound cultural heritage and strong ethnic characteristics, ethnic music constructs its own music cognition, enhances the humanistic, cultural, and spiritual significance of music, enabling music learning to reach a higher level. It provides young students with an important way to recognize the charm of their own ethnic culture and draw on cultural and spiritual strength ^[5]. By learning, performing, and creating ethnic music, students can directly feel the broad and profound nature and unique charm of Chinese culture, and enhance their sense of pride and belonging to their own ethnic culture in artistic practices. Ethnic music education not only improves students' artistic literacy but also subtly cultivates their ability to respect diverse cultures, identify with Chinese culture, and strengthen cultural confidence, thus gathering a powerful spiritual impetus for the great rejuvenation of the Chinese nation.

3. Analysis of the dilemmas in the teaching practice of forging and strengthening the consciousness of the Chinese national community in universities in border areas

With the continuous advancement of the consciousness of the Chinese national community at the national strategic level, the educational value of ethnic music in the education of universities in border areas has become increasingly prominent. As an important part of outstanding traditional Chinese culture, ethnic music not only carries profound cultural memories and ethnic emotions but also plays an irreplaceable role in promoting students' cultural identity and ethnic unity. Especially in border areas with multi-ethnic settlements, ethnic music education in universities should shoulder the important responsibilities of cultural inheritance, identity cultivation, and unity enhancement. However, despite continuous policy support from the state and increased awareness from all sectors of society, the educational practice of ethnic music in border universities still faces multiple challenges. There are obvious shortcomings in curriculum settings, teaching integration, and resource guarantee, affecting educational effectiveness and the internalization of the consciousness of the community. The following analyzes the main dilemmas currently faced from three aspects.

3.1. Insufficient organic integration of ideological and political education and ethnic music teaching

Ethnic music has a natural advantage in shaping students' cultural identity, ethnic pride, and the consciousness of the Chinese national community. However, in the actual teaching process, this potential has not been effectively tapped. Currently, most universities in border areas still focus on skill teaching and art appreciation in ethnic music courses, ignoring the in-depth integration of their ideological and political education functions^[6]. The curriculum content often stays at the surface level of knowledge instillation and skill training, failing to guide students to deeply understand the history, culture, and national unity logic behind ethnic music and lacking systematic value guidance. This leads some students to regard ethnic music as "entertainment" or "regional culture," making it difficult for them to connect with core values such as national identity and ethnic unity. Although some universities have tried to integrate ideological and political elements into the curriculum, such as introducing historical narratives or cultural interpretations in music, the teaching methods lack systematic design, and the implementation effects vary, failing to form a stable and effective teaching paradigm. Therefore, strengthening the ideological and political education function of ethnic music courses and promoting the transformation of curriculum content from perceptual aesthetics to rational identification is a problem that needs to be solved urgently in current teaching.

3.2. Lack of diversity, systematization, and integrity of ethnic culture in curriculum design

Currently, the curriculum design of ethnic music in universities in border areas is mostly limited to the music forms or representative repertoire of a certain ethnic group, lacking a systematic presentation of the music cultures of numerous ethnic groups in the Chinese nation. Many universities' ethnic music courses mainly focus on music inheritance, especially emphasizing some ethnic music with local characteristics, while ignoring the integrity and diversity of Chinese culture. For example, many ethnic unity and progress education courses in universities adopt a "cram-down" teaching method mainly based on "teaching." The teacher's lecture becomes a "monologue," and the teaching content is rather empty. Students often passively cope, lack effective interaction, and are unable to resonate, resulting in poor teaching effects^[7]. Such a single curriculum content restricts students' comprehensive understanding of multi-ethnic cultures, making it difficult for them to fully

recognize the richness and diversity of Chinese culture. For example, some courses may focus too much on the traditional music forms of certain ethnic groups, lacking the display of the music of other ethnic groups, and failing to show the integration and interaction of different ethnic cultures in the big family of the Chinese nation. This limitation weakens the positive role of ethnic music education in cultivating students' cultural confidence and ethnic unity. Therefore, ethnic music courses in universities should pay more attention to overall design. In teaching content, they should comprehensively consider the characteristics of different ethnic music and their contributions to Chinese culture, enhancing students' in-depth understanding and recognition of the consciousness of the Chinese national community.

3.3. Scarcity of teaching resources for ethnic music in border areas and insufficient construction of practical platforms

The choice of teaching methods usually depends on teaching objectives, student characteristics, subject content, and the teaching environment. Strengthening the consciousness of the Chinese national community among students of different ethnic groups is one of the core goals of education in ethnic universities^[8]. Ethnic music teaching requires not only rich theoretical support but also relies on diversified teaching resources and practical platforms such as fieldwork, cultural exchanges, and performance practices. However, currently, many universities in border areas still have insufficient investment in ethnic music education resources, especially in resources related to practical activities such as fieldwork and live performances of ethnic music. Although some universities have achieved certain results in theoretical teaching, due to a lack of sufficient cultural practice opportunities, students' cognition and experience in music learning are still limited to the classroom, making it difficult for them to obtain more vivid and intuitive cultural exposure. For example, some universities lack sufficient audio-visual materials related to ethnic music, music creation materials, and ethnic musical instruments and other teaching resources, restricting the diversity and depth of teaching. In addition, most of the existing ethnic music teaching platforms have problems such as insufficient cross-department cooperation and a lack of interactive communication, failing to effectively integrate resources from different disciplines, and restricting students' comprehensive experience and in-depth understanding of ethnic music learning. This shortage of resources leads to the fact that ethnic music teaching often cannot be more deeply connected with social reality, cultural innovation, and other aspects, further restricting the role and influence of ethnic music in forging and strengthening the consciousness of the Chinese national community.

4. Countermeasures for teaching practice to empower the forging and strengthening of the consciousness of the Chinese national community in universities in border areas

4.1. Strengthening the integration of ideological and political education and ethnic music teaching

To solve the problem of insufficient integration of ethnic music teaching and ideological and political education, universities in border areas should take forging and strengthening the consciousness of the Chinese national community as the goal, start from the top-level curriculum design and innovation of teaching concepts, and strengthen the in-depth combination of ideological and political education and ethnic music courses. In the teaching design with forging and strengthening the consciousness of the Chinese national community as the core, integrates ideological and political education by combining the achievements of outstanding traditional Chinese art culture. Through “nourishing the heart with beauty” and “cultivating the soul with virtue,” subtly

guide college students to establish correct ethnic consciousness and patriotism in the atmosphere of aesthetic education, and help them consciously identify and resist wrong ideas that split ethnic unity and undermine national unity ^[9].

Firstly, in terms of curriculum setting, forging and strengthening the consciousness of the Chinese national community should be clearly defined as one of the core goals of ethnic music courses. Especially in aspects such as the historical background, creative background, and social functions of ethnic music, conduct systematic explanations in combination with ideological and political education. Teachers can analyze the cultural significance and social value behind classic ethnic music works by analyzing them, helping students to draw ethnic cultural identity and a sense of social responsibility from them. For example, when analyzing works such as “Eight Hundred Li of Roasted Meat Under the Command” and “My Motherland,” not only should the musical forms be interpreted, but students should also be guided to think about the spiritual connotations of ethnic unity and national identity contained therein. Secondly, teaching methods also need to be innovated. Through case-based teaching, interactive discussions, situational simulations, and other methods, while students are appreciating and performing ethnic music, they can deeply understand the pluralistic and integrated nature of the Chinese nation and cultural commonalities, thus enhancing ethnic identity and the sense of community. In addition, teachers should regularly organize symposiums or cultural activities related to ethnic unity and cultural identity, allowing students to enhance their acceptance and recognition of ideological and political education through interaction and participation.

4.2. Optimizing curriculum design to fully demonstrate the diversity and unity of Chinese national music

The dialectical unity of “diversity” and “unity” is the theoretical basis for the formation of the consciousness of the Chinese national community ^[10]. Currently, there is a problem of singularity in the curriculum design of ethnic music in universities in border areas. Many courses pay too much attention to the music culture of a certain ethnic group or region while ignoring the diversity and integration of the music of other ethnic groups. In order to better demonstrate the diversity and unity of Chinese national music culture, universities should comprehensively optimize the curriculum design and construct a comprehensive and diverse curriculum system. In terms of content setting, in addition to teaching the traditional music of the Han nationality and ethnic minorities, music forms with ethnic integration characteristics should also be introduced to highlight the integration and interaction of different ethnic music. Specifically, universities can offer a series of special courses, such as “The Diversity and Unity of Chinese National Music” and “The Innovative Combination of Traditional Chinese Music and Modern Music.” Through special lectures, ethnic music concerts, and other forms, students can personally experience and feel the differences and commonalities of different ethnic music styles. Through these curriculum designs, not only can students understand the music cultures of different ethnic groups, but they can also help them understand the cultural integration and inclusiveness of the Chinese nation, enhancing their ethnic identity and cultural confidence. In addition, by inviting off-campus ethnic music experts to give academic lectures and exchanges, students can have a broader view of ethnic music, thus deepening their recognition and understanding of the culture of the Chinese national community.

4.3. Strengthening the construction of teaching resources and building diversified practical platforms

The scarcity of teaching resources for ethnic music in universities in border areas is a prominent problem in current university teaching. Especially in the teaching process, there is a lack of sufficient practical platforms,

making students lack practical cultural experiences and cognitions based on theoretical learning. Although the hardware facilities of universities basically meet the needs of music majors, the efforts in integrating the education of the consciousness of the Chinese national community are insufficient, and the high-frequency use advantage has not been fully utilized, affecting the deepening of the educational function^[11]. To make up for this deficiency, border universities should increase investment in ethnic music education resources, especially in the construction of teaching practice platforms, and create more practical opportunities to display and experience ethnic music. Firstly, schools can establish cooperative relationships with local cultural centers, art troupes, and folk musicians, and organize fieldwork and cultural exchanges of ethnic music, allowing students to perceive the charm of music in real cultural scenarios. For example, by having students conduct music fieldwork in ethnic minority-inhabited areas and understand the production and performance of ethnic musical instruments, their understanding of ethnic music and respect for multi-ethnic cultures can be enhanced. In addition, schools should actively promote cross-disciplinary cooperation both on and off campus, establish cross-department and cross-disciplinary teaching platforms, and combine departments such as music academies, cultural departments, and sociology departments to carry out cross-disciplinary teaching and research on ethnic music, cultural identity, and social value. Through diversified cooperation and practical platforms, students can comprehensively understand the diversity of ethnic music and feel the profound heritage of Chinese culture. Secondly, schools should actively explore the development of digital teaching resources, use virtual reality technology and digital music libraries, and other tools to create virtual ethnic music classrooms, and provide students with diversified learning methods. Through these modern means, the interactivity and practical learning can be enhanced.

5. Conclusion

With the continuous advancement of the construction of the consciousness of the Chinese national community, the role of ethnic music in enhancing cultural identity and promoting ethnic unity has become increasingly prominent. Especially in universities in border areas, ethnic music education not only shoulders the mission of cultural inheritance but also serves as an important way to cultivate students' national identity and ethnic unity consciousness. Through systematic and diverse teaching practices, ethnic music can help students understand the pluralistic and integrated nature of Chinese culture, enhancing their cultural confidence and sense of responsibility. However, currently, there are still many constraints in curriculum design, teaching methods, and resource allocation, which affect educational effectiveness. Therefore, border universities need to further promote the in-depth integration of ethnic music and ideological and political education, optimize the curriculum structure, strengthen the practical links, build diversified teaching platforms, and improve the educational quality and effectiveness of cultivating people. In the future, it is necessary to continuously deepen the teaching reform of ethnic music, expand the depth and breadth of cultural education, lay a solid foundation for cultivating new-era youth with a high degree of cultural identity and ethnic responsibility, and help the consciousness of the Chinese national community take root and thrive in border areas.

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AI Empowerment in Higher Education: Current Opportunities, Key Challenges, and Future Trends

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Abstract: As higher education undergoes rapid digital transformation, new technologies are reshaping the way institutions teach, support, and engage with students. This paper explores how intelligent systems are being used to personalize learning, improve academic support, and streamline administrative processes. While these tools offer clear benefits, they also raise important concerns around access, equity, privacy, and institutional readiness. Drawing on recent literature and case studies from various countries, the study highlights both the promise and complexity of integrating new technologies into higher education. It concludes with a call for thoughtful, inclusive strategies that ensure innovation supports all learners and strengthens the core values of education.

Keywords: Higher education; Educational technology; Digital transformation; Personalized learning; Equity in education

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1. Introduction

Artificial intelligence (AI) has emerged as one of the most influential technological developments of the 21st century, transforming numerous sectors—including healthcare, finance, and transportation—and increasingly permeating the realm of education. In the context of higher education, AI represents a paradigm shift, offering innovative solutions to long-standing challenges while simultaneously presenting new questions regarding ethics, access, and pedagogical effectiveness. As universities and colleges across the globe embrace digital transformation, AI has become central to reimagining how education is delivered, managed, and experienced^[1,2].

The integration of AI in higher education encompasses a wide spectrum of applications, from intelligent tutoring systems and automated grading to predictive analytics for student performance and AI-driven administrative workflows. These technologies promise to enhance the personalization of learning^[3,4], improve institutional efficiency^[5], and expand access to quality education for diverse and dispersed student populations^[6]. Moreover, AI holds the potential to empower educators by providing actionable insights, enabling differentiated

instruction, and automating routine tasks to allow greater focus on mentorship and innovation.

However, the deployment of AI in academic environments is not without its complexities. Issues such as algorithmic bias, data privacy, unequal access to technology, and the readiness of educators and institutions to adapt to these tools pose significant challenges. Furthermore, the rapid pace of AI innovation outpaces regulatory and ethical frameworks, raising concerns about accountability, transparency, and the human dimensions of learning ^[7,8].

This paper seeks to examine the evolving role of AI in higher education by exploring three key dimensions: the current opportunities enabled by AI, the critical challenges that hinder its equitable and effective implementation, and the future trends that are likely to shape its trajectory. Through an interdisciplinary lens that integrates educational theory, technological analysis, and policy considerations, this study aims to provide a comprehensive understanding of how AI is reshaping the landscape of higher education and what it means for the future of teaching, learning, and institutional leadership.

2. Research method

This study adopts a qualitative research approach and draws on two main sources of information:

- (1) Literature review: The paper is grounded in a review of existing academic literature, policy reports, and institutional documents that explore the use of artificial intelligence in higher education settings.
- (2) Comparative case studies: Several case studies from universities in the United States, China, Finland, and South Korea are analyzed to highlight different approaches to AI implementation ^[8]. These cases provide insights into institutional strategies, practical challenges, and the impact of national policies and infrastructure.

3. Results and discussion

3.1. Enhancing learning and academic support

In many higher education institutions, digital tools are being used to enhance the learning experience and make academic support more responsive. These tools allow for more flexible approaches to instruction, giving students the ability to revisit materials, learn at their own pace, and receive targeted feedback based on their performance. This flexibility is particularly helpful for students balancing coursework with work or family responsibilities.

Course management platforms now allow instructors to track participation, assignment completion, and assessment results in real time ^[9]. With this information, educators can more easily identify students who may be struggling and offer timely support, such as follow-up meetings, supplementary materials, or referrals to academic services. This shift from reactive to proactive support marks a meaningful change in how institutions engage with students.

Beyond the classroom, student services have also become more accessible. Many universities have introduced automated response systems that help students navigate administrative processes—such as enrollment, financial aid, or advising—more quickly and independently. These systems improve efficiency and reduce wait times, especially during peak periods like course registration. The result is a more student-centered approach that helps individuals feel supported both academically and administratively.

3.2. Addressing access and equity challenges

While digital tools have broadened the reach of higher education, not all students benefit equally. For some, especially those from under-resourced communities, limited access to reliable internet, personal devices, or quiet study spaces remains a major barrier ^[10]. These gaps have become more apparent with the expansion of online and blended learning, where access to basic technology can determine whether a student succeeds or falls behind.

Even within well-equipped institutions, disparities exist in how students engage with digital learning. Differences in digital literacy, comfort with online systems, and prior exposure to independent study methods can affect academic performance ^[11]. Without proper orientation and support, some students may find these learning environments isolating or overwhelming.

Another concern is the growing reliance on student data to inform instructional and institutional decisions. While data can help improve services, it also raises ethical questions—particularly when students are unaware of how their information is collected or used. Transparency is essential. Institutions must clearly communicate data practices, ensure student consent, and guard against potential misuse or bias ^[12].

To truly make education more accessible, universities must take a holistic view of student needs—offering not just devices or platforms but also digital skills training, academic guidance, and safe, inclusive learning environments. Equity should be built into every stage of digital development, not treated as an afterthought.

3.3. Institutional readiness and financial concerns

While digital tools have introduced new possibilities for teaching and learning, their success depends heavily on how well educators and institutions are prepared to use them. Faculty often face the expectation to adopt new systems quickly, even when they have limited experience or training ^[13]. Many express uncertainty about how to meaningfully incorporate digital platforms into their teaching without compromising academic rigor or student engagement.

Professional development remains a critical, yet sometimes overlooked, factor in effective integration. Short, one-time workshops are often insufficient. What educators need are ongoing opportunities to explore new methods, share practices with peers, and receive practical support tailored to their disciplines. When this kind of structured support is provided, faculty are more likely to feel confident in experimenting with new approaches and adjusting their teaching to meet evolving student needs.

Institutional leadership also plays a central role. The transition to digital learning environments requires more than individual effort—it demands coordinated planning, investment, and a clear vision. This includes ensuring that teaching staff have not only access to necessary tools, but also time and incentives to adapt their work. Institutions that prioritize training, build interdisciplinary support teams, and involve educators in decision-making are better positioned to make lasting improvements ^[14].

Financial constraints are a common challenge, particularly in smaller or underfunded institutions. Upgrading systems, maintaining infrastructure, and hiring skilled support staff require ongoing resources. For some universities, this means making difficult trade-offs or relying on external partnerships to share costs and expertise. Careful planning and long-term commitment are essential to avoid uneven implementation across departments or student populations.

In essence, the effective use of digital resources in higher education is not just a matter of technology—it is a matter of people and policy. Empowering educators and building institutional capacity are foundational steps toward sustainable and meaningful innovation.

3.4. Rethinking assessment and student engagement

As teaching methods evolve, so must the ways in which student learning is evaluated. Traditional exams and essays remain useful, but they often fall short in capturing the full range of student understanding—especially in more flexible or self-directed learning environments. Many educators are now exploring alternative approaches such as group projects, presentations, reflective journals, and continuous coursework ^[15]. These forms of assessment encourage critical thinking, creativity, and collaboration, providing a more complete picture of student progress.

This shift also reflects a broader effort to make assessment more meaningful. When students are given varied ways to demonstrate their learning, they are more likely to stay motivated and feel that their efforts are recognized. However, designing these kinds of tasks requires time and careful planning to ensure fairness, clarity, and alignment with learning goals.

Student engagement is closely linked to how learning is structured ^[2]. Simply attending a class or completing online tasks does not always indicate true involvement. In response, instructors are creating more interactive and participatory experiences—such as live discussions, peer feedback, and small-group activities—to keep students connected and involved. These efforts not only deepen learning but also help build a stronger sense of community, especially in hybrid or remote settings.

At the same time, it is important to acknowledge that students engage in different ways. Some may prefer independent study, while others thrive in discussion-based environments. Providing clear expectations, varied opportunities for interaction, and regular feedback can help ensure that all students remain active and supported, regardless of their learning style.

In rethinking both assessment and engagement, institutions have the chance to move beyond rigid models and create learning environments that are more inclusive, practical, and responsive to students' needs.

4. Conclusion

The growing use of digital technologies in higher education is reshaping how institutions teach, support, and engage with students. From personalized learning tools to predictive academic support and more responsive services, these innovations have the potential to enhance both educational quality and operational efficiency. When implemented thoughtfully, they can make learning more flexible, improve student outcomes, and ease administrative burdens.

At the same time, these benefits are not equally accessible to all. Uneven access to digital resources, concerns over privacy, and gaps in faculty readiness highlight the importance of addressing structural barriers alongside technological change. Without careful planning and support, efforts to modernize education may unintentionally deepen existing inequalities.

Moving forward, institutions need to strike a balance between embracing innovation and ensuring fairness. This means investing not only in infrastructure and tools, but also in people—through professional development, inclusive policies, and a strong commitment to equity. With the right foundation, higher education can harness technology to build more responsive, inclusive, and future-ready learning environments.

Disclosure statement

The author declares no conflict of interest.

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An Exploration of Teaching Strategies for News Listening in College English Test Band 4

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Abstract: After the reform of CET-4 listening test, news listening has become another obstacle for students to improve their listening level. Aiming at the generally weak English listening level of non-English majors in independent colleges, this paper analyzes the difficulties in the news listening part of the CET-4 reform based on the characteristics of English news, and puts forward corresponding teaching strategies to develop students' proficiency in English news listening.

Keywords: College English Test Band 4; News listening; Teaching strategies

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1. Introduction

Since June 2016, the listening part of CET-4 has been reformed again. On the basis of canceling the original short conversation and short essay dictation, a new content of short news listening has been added. News listening, which was originally a type of question in TEM-4, now appears in College English Test Band 4. The requirements for students' listening level and its difficulty can be imagined. At the same time, the author conducted a survey among the sophomores in three classes of the Institute of Changchun College of Electronic Technology, and found that nearly 80% of the students think that the main failure point in the listening test is news. Therefore, this paper will combine the characteristics of news reports, summarize the difficulties of CET-4 news listening, and put forward the corresponding teaching countermeasures. It is hoped that this paper will help students develop listening proficiency and arouse teachers' thinking and the improvement of news listening teaching.

2. Characteristics of English news and analysis of listening difficulties in College English Test Band 4

Different from other ESP (English for specific purpose) such as scientific English, agricultural English, and legal English, news English has specific vocabulary, syntax, structural features, and background information.

If students are not trained enough in news listening, they will lack the understanding of news features, the accumulation of background knowledge, and the summary of listening skills, thus causing difficulties in listening comprehension, which are embodied in the following aspects.

2.1. Memorization of news words

The subject matters of CET-4 news listening involve politics, economy, culture, sports, science and technology, military, and other aspects. In terms of language, news language is easy to understand and conforms to the features of written language. On the basis of simplicity and regularity, common basic words and some proper nouns used in daily life have also become indispensable components of news language characteristics. Therefore, mastering news English vocabulary has become an inevitable way for students to improve their news comprehension ability ^[1].

Another difficulty in vocabulary examination is the conversion of synonyms, that is, the similar expression of a word. For example, the word tested in the question is “promote,” while what you hear in the news is “boost,” “encourage,” or “enhance.” If students can link these synonyms together, they need to generalize and summarize more synonyms in English learning.

2.2. Mastery of news syntax

The most common sentence structure of news is embedded structure, which is determined by the fact that the concise sentences of news need to accommodate highly condensed content. Sentences are mostly extended by subject-predicate or subject-predicate-object structure, and insert attributive, adverbial, appositive, participle, or clause are used as modifiers ^[2]. Many students’ grammatical awareness is weak, only understand from the visual input. It is relatively difficult for students to reprocess information from the auditory approach. For instance, students often confuse the predicate or modifier components of the main sentence and clause in listening.

2.3. Understanding of news structure

In terms of the structural characteristics of news, English news reporting is also rather different compared with Chinese news broadcasting. Most of the English news reporting methods are organized and arranged according to the importance of news events. The author puts the most important, exciting, and most concerning parts at the beginning of the article, the secondary parts later, and the least important parts at the end. This pattern of decreasing the importance of information is still relatively fixed and routine in English news reporting. The common news structure in CET-4 is the “inverted pyramid” structure, that is, the most general and condensed information is placed at the beginning of the news report, usually the first sentence, also known as the news lead. The relatively minor information is followed by a description ^[3]. The news lead summarizes the core content of the whole news, which is stated by the six elements of the news composed of five Ws and one H (who, what, when, where, why, how). If students do not understand the news structure or fail to grasp the key information in the news due to nervousness, they will not be able to grasp the news content as a whole, resulting in a loss of marks.

2.4. Familiarity with background knowledge

Whether students can understand the content of news largely depends on the accumulation of background knowledge. For example, to understand news about the “Palestinian-Israeli conflict,” they must be familiar with the geographical location of the two countries, the history, politics, and religious origins of the conflict, and

the information about the Islamic resistance movement. Only in this way can they have a deep understanding of the news and get the topic right. However, many students have not formed the habit of reading books and newspapers, paying attention to domestic and foreign events, and have little understanding of news, which will inevitably cause obstacles in listening comprehension.

2.5. Use of listening skills

Students will learn news listening skills in class, such as introduction, prediction, catching keywords, paying attention to synonym conversion, etc., but many students cannot use them flexibly in the actual exam. Without the listening method as a guide, it is difficult to capture important information while listening. In addition, students should master the skills of understanding questions. Many students analyze questions slowly. They cannot finish reading questions before listening, so they would read questions while listening. Without good short-term memory ability, they would get fuzzy information and hesitate to answer questions.

3. Teaching strategies

Based on the above analysis of the difficulties in news listening, it shows that as long as students understand the characteristics of news and listen and practice more, they can improve their CET-4 news listening scores relatively quickly. Therefore, when teaching, teachers should combine the characteristics of news for explanation and listening practice.

The first strategy to be noted for English listening training is the meta-cognitive strategy.

Meta-cognitive strategies are the consciousness of human cognitive activities and the self-assessment and coordination during the activity process. They mainly involve learners' learning attitudes, training methods, learning process management, and learners' self-regulation. Meta-cognitive strategies are particularly important for students training their English listening skills, as they can actively control cognitive behaviors.

According to the guidelines of meta-cognitive strategies, teachers should negotiate with students on the methods and strategies of English listening training based on their own current characteristics, so that students can carry out English listening training in a planned manner according to their own situations. More importantly, in this situation, students will be able to supervise themselves through self-assessment and self-reflection. It should be encouraged that teachers evaluate students and students evaluate each other, thereby stimulating students' initiative and enthusiasm in learning English.

3.1. Carrying out dictation training of vocabulary

Vocabulary is the basis for listening comprehension. Students usually memorize words in the news through reading, so the vocabulary they accumulate is visual vocabulary, not auditory vocabulary. In order to change the visual vocabulary into auditory vocabulary, they should pay more attention to the pronunciation of the words, and consolidate it with dictation training. The content of dictation training should be paid close attention to. Before the dictation, the teacher could classify the vocabulary, such as proprietary vocabulary, abbreviated word, new words, etc., to facilitate the students' memory; In dictation, do not take a single word as a unit of dictation, but to take classified words into the corresponding news phrases and sentences, which is conducive for students to grasp the pronunciation and usage of vocabulary as a whole.

3.2. Developing the ability to listen for key words

When students listen to the news, not every word or detail of information can be understood, nor do they know

which information is important or not important, so how to grasp the key information when answering the questions is what students need to learn. First of all, teachers should teach students to grasp the key information in the news lead—five Ws and one H (when, where, what, who, why, and how) ^[4]. Secondly, teach students to pay attention to the division of sentence meaning groups, find the key words in long, difficult sentences, such as predicate, object, attributive, adverbial, etc., and pay attention not to confuse the main sentence and the components of the clause. Finally, teach students to underline the key words, that is, the corresponding information of the question test points and options, and catch the corresponding key words in the news, generally they are synonyms. During training, teachers can use the retelling method to ask students to retell the key words of each sentence, and cultivate students' ability to filter secondary information and grasp the core of the sentence.

3.3. Strengthening the ability to read and retell news

Promoting listening by reading and speaking is the most effective way to improve news listening. Teachers can collect hot news reading materials from English newspapers and magazines or the Internet regularly and send them to students to read after class. In reading, students are required to sort out and memorize the key words involved in the news, analyze the structure and syntactic structure of the news, and summarize the general idea of the news through the lead. In class, students are required to retell the general idea of the news to give feedback on their reading. Then, the teacher plays and reads the relevant news listening materials for students to listen to, and then retells the key content after listening. In this way, reading and listening can be repeated. Through reading, students can expand their vocabulary, accumulate their background knowledge, and consolidate what they have listened to. Therefore, it is very necessary to read and speak the news.

3.4. Stimulating learning interest through audio-visual integration

To do a good job in English listening training, teachers should start from the perspective of students' learning. Efforts must be made to break the original mode of "listening," achieve "audio-visual integration," bring new vitality to students' learning, and thereby stimulate students' interest in learning English. This requires teachers to carry out various news listening training activities for students in class or during their spare time.

Students can experience and immerse themselves in specific scenarios in the forms of "simulated real-time messages," "travel simulation," and "message broadcast simulation." Establish a complete and orderly knowledge system through teaching both inside and outside the classroom to stimulate students' interest in learning. A perfect knowledge system of news English will improve students' learning efficiency and increase their interest in learning. For students, through the rich content and training materials of English courses, they can listen to more English news and gradually organize a systematic knowledge system of English news. At the same time, mobilizing multi-sensory learning is conducive to creating students' initiative and enthusiasm in learning and optimizing the classroom atmosphere for news English listening training.

3.5. Improving students' memory

Meta-cognitive strategies at the macro level have various specific training strategies, such as memory strategies. Memory mainly includes working memory, short-term memory, and long-term memory, while the processing of information for learning and memory strategies in the process of English listening mainly depends on working memory and short-term memory. However, due to the limitations of short-term memory and storage time, listeners must adopt appropriate note-taking strategies to record detailed information about long articles,

such as age, time, location, and other related information. During the learning process, one should be able to digitally remember and store the unique pauses that capture English breathing and rhythm to record necessary information, including abbreviations, associations, or self-created symbols. Remember and activate the understanding and analysis of the original information by means of symbols^[5].

During the news listening test, students often forget information while listening. Due to the vague information they remember, they often hesitate when answering the questions. Many students attribute the reason to nervousness, not knowing that there are other factors. Memory is the prerequisite for understanding, and understanding is the sublimation of memory^[6]. To improve memory, one should also apply techniques, such as taking notes while listening, except more reading, listening, and speaking after class to enhance the understanding of news. Following the speed of the announcer, write down the key points of the news, including data, time, place, cause, process, and result etc. In order to achieve short-term shorthand, students could use the first letters, symbols, or abbreviations of the words they understand more often instead of complete words, such as prof.-professor; Am-America.

4. Conclusion

In conclusion, as a rigorous formal genre, English news listening materials exhibit their particularities in terms of sentence structure, syntactic features, vocabulary, culture, etc. This poses higher requirements for both the implementers and participants of listening activities, and definitely determines that English news listening teaching, as an important component of listening teaching, is different from other styles' listening teaching.

The proficiency of English news listening cannot be improved overnight. Students need to constantly reflect during training, discover their own learning weaknesses, find corresponding solutions, and persist in training. Teachers should center on students' learning, grasp the difficulties in news, adopt effective teaching methods, and establish a supervision mechanism to help students overcome obstacles. Only in this way can they help students improve their English news listening comprehension ability more effectively and thereby comprehensively enhance their English listening comprehension level.

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English Language Teaching Goals: Embracing Global Varieties for Effective Communication

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Abstract: In the contemporary era of globalization, English has evolved into a multifaceted tool for intercultural communication, transcending its traditional boundaries. This paper explores the shifting paradigms in English language teaching (ELT), moving away from the pursuit of native-like competence towards a more pragmatic focus on communicative proficiency in English as a Lingua Franca (ELF). Through an examination of global English varieties and ELT goals, the paper argues for a pedagogical approach that embraces linguistic diversity and prioritizes effective communication over conformity to native norms. Drawing on insights from ELF research and communicative language teaching methodologies, it advocates for empowering learners with the skills to navigate diverse linguistic contexts and engage in meaningful interactions with speakers from diverse cultural backgrounds.

Keywords: English as a Lingua Franca (ELF); Global Englishes; English language teaching; Intercultural communication

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1. Introduction

With the development of globalization, English is widely used than ever before, as users from different cultural and linguistic backgrounds would use English as a tool for intercultural communication. The number of non-native speakers (NNS) of English around the world is way more than native speakers (NS). Hence, it is not surprising to see that the language is diversifying and “English” has become “Englishes”^[1]. Some people in the Outer Circle or the Expanding Circle probably still think that English belongs to speakers in the Inner Circle and regard to be nativelike as their goal of learning English, ignoring the fact that they are one of the empowered English users. The traditional framework of English language teaching, which incorporates English as a foreign language (EFL), is not practical now because it is not in line with the ongoing process of English as a Lingua Franca (ELF)^[2]. Therefore, the goal of English language teaching should be adjusted according to the trend of ELF.

2. English worldwide

Due to the military action and the formation of empires, English was spread around the world; hence, as the language is widely used, it becomes a useful intermediate of communication, which, in other words, English is used as a lingua franca globally ^[3]. This trend of global Englishes is defined as “an inclusive paradigm looking at the linguistic, sociolinguistic, and sociocultural diversity and fluidity of English use and English users in a globalized world” ^[2]. Also, different varieties of English can be found around the world, such as Indian English, English in Canada, English in Australia, Sri Lankan English, English in Singapore, Slavic English, and so on.

However, English has a different status in different countries. To classify English used around the world in different countries, Kachru came up with the “three circles model” ^[3]. First of all, it is the Inner Circle, in which most people have English as their native language (ENL), for example, the United Kingdom, the United States, Canada, Australia, New Zealand; second, due to the colonization, the Outer Circles includes countries like India, Singapore, Bangladesh, Kenya, Zambia, and so on, use English as the second language (ESL) in the fields of education, law, politics, and so on; thirdly, the countries, where English is used as the foreign language (EFL), been defined as the Expanding Circle, such as China, Japan, Egypt, Israel, etc., where people use English to communicate with people from other language backgrounds in the fields of business, education, etc. ^[1]. The three circles reflect the different modes of spread, acquisition patterns, and functional allocations of English in various cultural contexts. According to Kachru, the English used in the Inner Circle provide the norm for English use, the English used in the Outer Circle develop this norm and that in the Expanding Circle dependent on that norm, which in other words, while Englishes in the Outer Circle have become institutionalized and are forming their own standards, the Englishes in the Expanding Circle are seen as “performance” varieties, with no official standing and therefore reliant on the rules set by natives from the Inner Circle ^[1]. This may explain why some learners’ goal of learning English in some countries in the Expanding Circle is to become nativelike. It may also indicate the reason why English undergoes a process of nativization, and as a result, the different new, local dialects of English have developed in different countries or regions ^[4].

The three-circle model has a great impact on sociolinguistic research, yet some limitations can be found. Specifically, this model is built on geographical and historical elements rather than how speakers currently identify with and use English, but in fact, there are a large number of native speakers in the Outer Circle and vice versa, plus, pidgins and creoles do not fit into this model. Besides, there is a grey area among the three circles, which in other words, English may be learnt as the L1 for many individuals in some Outer Circle countries, and some countries, such as Belgium, Denmark, Argentina, are in transition from EFL to ESL status. What’s more, the term “Inner Circle” implies that speakers who come from ENL are central, which may be interpreted as superior ^[1]. Hence, to improve this model and to take account of more recent developments, Modiano modified his centripetal model and came up with his English as an international language (EIL) theory, which the center is EIF, a core of characteristics which the majority of native and competent non-native speakers of English can understand, the second circle includes traits which may become common internationally or may fade into obscurity and the third area contains five groups: America English, British English, other major varieties like Canada English, Australia English, New Zealand English etc., local varieties and foreign language varieties, each with features unique to their own speech community and seem cannot to be understood by speakers from other groups ^[1].

3. Goal of ELT

3.1. Near-native competence as an ELT goal

As mentioned before, the Inner Circle sets the norm of English use, and speakers from the Outer Circle and the

Expanding Circle feel that if they want to immerse in native speakers' culture or community and communicate with them, they need to follow the norm and be similar to native speakers. Research on second language acquisition in the past found out that sometimes it specified the aim of L2 learning explicitly: language pedagogy is concerned with the ability to use language in communicative situations, but more frequently, it subtly: the age debate centers on "whether the very best learners have native-like competence," which in other words, successful L2 learners are those who can use English like native speakers ^[5]. Therefore, to fulfil the goal of native-like in English learning, the coursebook writers and the policymakers work so hard to create the textbook in line with the Standard English, which is British English or American English, also called Standard British English or Standard American English, so, teacher as well as learners refer to those coursebooks and try to reach the target of "standard" blindly. Nevertheless, when they communicate with the native speakers, they may still meet some troubles, for example, cannot understand the idiom used by the native speakers, or hard to follow their interlocutors because of their accent or speed.

EFL emphasizes the importance of learning things related to the native speakers' culture and society as well as the significance of mimicking the language behavior of native speakers ^[6]. Also, EFL approaches see the learner as an outsider or a foreigner who struggles to gain recognition from the native speakers' community. In some countries in the Outer and Expanding circles, English has traditionally belonged to the school curriculum, in which English was treated as a timetabled subject, with emphases on grammatical accuracy, native-like pronunciation, and literature. In this situation, if EFL learners are measured against the "standard," few of them will be perfect ^[6]. Besides, in those countries where people need to pass English exams to get a promotion or graduation, it has often resulted in considerable pressure and resentment by learners, rather than significantly improving their English proficiency. Hence, chasing the goal of being a native speaker indicates that learning a second language can only lead to a different degree of failure, rather than success, which undoubtedly would be demotivating ^[5].

It is important for learners to refer to the native speaker's language competence, proficiency, or language knowledge for the second language proficiency definition used in language instruction ^[7]. Hence, the most suitable language teacher is definitely the native speaker who can present the target language that learners can imitate. However, it is hard or unlikely for the second language learner to become a native speaker, as according to the definition, we cannot be the native speaker of any language other than our first language ^[5]. Also, the pure "native speaker" is hard to find, as there are still differences among speakers in the inner circle. For example, the speaker who comes from New York will undoubtedly have a different accent from the speaker from Sydney. More commonly, English teachers in the Expanding and Inner Circles are non-native speakers. The learning goal of native-like proficiency has exposed these non-native English-speaking teachers (NNESTs) to some degree of discrimination. To illustrate, Mahboob claimed that native English-speaking teachers (NESTs) will present a better teaching and learning model, while the NNESTs who are not in touch with NESTs would underperform ^[8]. What's more, NNESTs are in a difficult situation, as compared with the language proficiency of NESTs, NNESTs were characterized by language deficiencies. Yet, in both ESL and EFL contexts, most NNESTs have a sufficient degree of language proficiency to complete their teaching duties ^[9] and English proficiency is determined by the capacity owned by both NS and NNS to use the language appropriately, rather than birth. Besides, NNESTs have a number of advantages that NESTs do not have. Initially, they are more able to predict the anticipated language difficulties that learners would face; secondly, they can be more sympathetic to the demands and troubles of the learner; thirdly, only NNESTs can take advantage of sharing their learners' L1; and fourthly, NNESTs can effectively instruct learning strategies ^[8].

The truth is native speakers are a minority in the number of English speakers around the world, and more often or not, people in the Outer Circle or the Expanding Circle use English to communicate with non-native speakers^[8]. To be more specific, a Chinese tourist buys a souvenir in a store in Japan, an Italian young man works in a restaurant in London, or an American businessman signs a contract with a Vietnamese. This indicates the trend of English as a lingua franca.

3.2. Exploring the goals of ELF

3.2.1. English as lingua franca

Global Englishes is regarded as an umbrella term that includes World Englishes (WE) and ELF ideologies^[10], which is also a sociolinguistics model that aims to limit the linguistic and regional barriers of English, decrease its differences in diversity, and acknowledge its diversity and dynamics^[2]. With the increasing cross-cultural interactions, English grows so fast and no longer belongs to native-speaking groups, but the ownership is now shared by all its speakers^[7,8]. ELF has come up as the first truly “global linguistic” phenomenon^[11] and it concluded that ELF means English is used as a contact language among speakers with different L1 who need it as an intermediate language to communicate with each other^[1], according to which, the majority speakers of English are NNS, and rather than being judged against an NSE criterion, all English varieties are recognized in their own right, no matter it is native or non-native. From the perspective of ELF, once NNSs stop to learn English, they are not the “failed native speakers” of English, but rather highly skilled language users who are able to take advantage of their multilingual abilities in ways that are not available to NSs who are monolingual, and also who prefer successful communication over limited conceptions of “correctness”^[12]. The ELF stresses the successful communication, interaction, and negotiation of meaning across different communities.

The English language has become a global lingua franca in part as a result of globalization; however, large-scale globalization is still contingent on the advent of an internationally diffuse lingua franca. There are many actions made to respond to globalization and ELF. Specifically, TESOL, one of the biggest and most prominent professional organizations for English language teachers around the world, has in recent years released a series of position statements related to ELF. First of which is addresses the fallacy that compared with NNSs, NSs are automatically preferred as language teachers due to the misguided belief about the outstanding linguistic competence of NSs, consequently, NNESTs always face employment discrimination^[14]. Hence, the statement illustrates that NNESTs can bring an inimitably valuable perspective. The second statement emphasizes that language proficiency just one of the criteria for evaluating the expertise of a language teacher, which in order to fit with the perspective of ELF, it also makes the important point that English is more like an additional language than a foreign language, as it spread so widely and the variety of English being spoken globally, what’s more, using a singular or monolithic method to standardize English is not viable anymore^[13].

3.2.2. To be exposed to a variety of English and to be communicative as the goal

As mentioned before, English learners will most likely use English to communicate with other non-native English speakers. If English language teachers simply teach learners that English complies to a singular “standard,” students would not be well-prepared to use the language. It said that it is English language teachers’ duty to prepare learners to use the language in this globalized world, where speakers speak and use English in a way that is different from prescribed standards^[10]. Also, Jenkins mentioned that ELF researchers believe that any speaker engaging in international communication should be familiar with as well as know how to use the certain forms that are widely used and comprehensible across English speakers with different L1 backgrounds^[14]. In other words, teachers should let learners be exposed to different varieties of English, which are the legitimate

models of communication, so that students would be more well-prepared for Englishes they might encounter in the future and communicate with others more successfully. Specifically, teachers can let learners familiarize themselves with the similarities and differences in pronunciation, accent, or expressions among Englishes, so that students would be able to understand their interlocutors in the future.

The language competence of speakers is defined by perspectives that include not only grammar and lexis, but also how members of a group use the language to accomplish their goals and are related to the interpersonal abilities crucial to communicate effectively and properly by using that language ^[15]. Therefore, to improve students' communicative competence, communicative language teaching (CLT) became popular. CLT emphasizes interaction-based tasks that are conducted entirely in the target language. These tasks often require filling the information gap, for which students request and offer information necessary to complete the task by working in groups, nevertheless, in CLT, it also includes student-focused task, in which students can share their experience with each other, for example, giving their opinion about some event or talking about their daily life. Hence, two axioms of CLT have been concluded: the first one is that it is necessary to speak and speaking is inherently good; secondly, through speaking, one learns how to speak.

CLT then transformed to the task-based language teaching (TBLT), which as implied by name, sees tasks as its center. In this teaching method, tasks serve as the language learning trigger because of the way in which their meaning-centeredness and goal-orientation stimulate the process of language cognition that contributes to meaning. This kind of activity related to cognition is regarded to start with the action of negotiation for meaning, in which, "in an attempt to interact, students and capable speakers show and articulate signs of their own and their interlocutor's perceived comprehension, thereby provoking changes to the choice of lexis, the structure of conversations, the content of the message, or all of them, until they reach a decent level of understanding ^[15]". This process seems similar to what students would encounter in the future when they communicate with people from different countries and try to understand each other through negotiating the meaning. Hence, Seidlhofer commented that in the era of CLT and TBLT, the language presented in the learning process should be the "real" language that will be used in daily communication, in other words, should be "authentic," rather than the idealized "textbook English," and as most people and their interlocutors are not native speakers, the "most real English" spoken by majority people is ELF ^[1].

Besides, it suggested that teachers should spend relatively less time on ENL norms, especially if those norms are less used in learners' communities, and try not to penalize innovative non-native like but intelligible forms ^[13]. Moreover, to ensure students be communicative, teachers should focus more on teaching communicative strategies, for example, prioritizing learners' accommodation skills, training learners to gauge and adjust to their interlocutors' repertoires, instructing students to signal whether their interlocutors understand them or not and telling learners how to ask for or provide repetition, therefore, learners would know how to keep the conversation going and negotiate the meaning, and consequently, be more confident and successful in communication in the future.

4. Conclusion

At present, English is no longer dominated by native speakers and the ownership is shared by all the speakers. To pursue to be native-like is outdated, and learn "standard English" is not compatible with this globalized world anymore. Although it would be helpful if learners refer to the native speaker's language competence, proficiency, as well as knowledge of the language during their learning process, it is unnecessary and unrealistic to try hard to become native-like. As different varieties of English can be found around the world today and

the group of non-native speakers is much bigger than that of native speakers, it is unwise to still measure the English learner against the “standard.”

In today’s world, where English is used as a lingua franca, the goal of English language teaching should be adjusted to help learners to be communicative. To meet students’ needs to communicate with other people from different first language backgrounds by using English as a common language, most commonly non-native speakers, English language teachers should introduce various aspects of English to the learner and try to improve their communicative competence by creating the authentic situation or exposing them to the authentic language. Also, teachers can teach learners some useful communicative strategies to guarantee that students can keep the conversation going and have a natural as well as fluent conversation with other speakers in the future.

Disclosure statement

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Discussion on Artistry and Techniques of Role Shaping in Drama Performance

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Abstract: Role shaping in dramatic performance is a fusion of art and skills, which involves the deep digging of character, the delicate expression of emotion, and the logical construction of behavior. Actors not only analyze the script and understand the emotions of the role to create a multi-dimensional, three-dimensional character image, but also need to use the skills of sound, form, lines, and so on, to convey the role's internal emotions and psychological changes. This process tests the artistic accomplishment and skill level of the actors, and requires them to have keen observation and rich imagination and creativity. Through the analysis of the role of Yu Ji in the Peking Opera *Farewell My Concubine*, it shows the deep integration of artistry and skill, highlighting the unique charm of dramatic performance.

Keywords: Role shaping; Emotion expression; Dramatic skill

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1. Introduction

Dramatic performance is an important form of artistic expression, and role shaping is one of the core elements of dramatic performance. On the stage of drama, actors can use their superb acting skills and deep understanding of the role to bring the characters in the script to life in front of the audience. This process not only tests the actor's artistic accomplishment and performance skills, but also contains a rich integration of artistry and skill. Therefore, an in-depth study of the artistic connotation and skill application of role shaping in dramatic performance can provide useful guidance for dramatic actors and promote the continuous development of dramatic performing arts.

2. The artistry of role shaping in dramatic performance

2.1. The depth of character excavation

In dramatic performance, the deep exploration of character is the key to the artistry of character creation. Actors need to conduct script analysis, character background research, and self-emotional experience, etc., to dig

deeply into characters' personality traits, including their external behavior and inner psychology. This process requires actors to have keen observation and deep insight, as well as rich imagination and creativity, in order to transform the flat words in the script into three-dimensional, vivid characters. When digging into a character's personality, an actor should first pay attention to the characters' basic character traits, such as bravery, cowardice, kindness, and cunning. These characteristics are usually reflected by the characters' mannerisms, attitudes towards others, and reactions in the face of difficulties. Actors need to analyze these characteristics in detail and accurately present them in their performances. The actor also needs to delve into the inner world of the character, including the influence of his upbringing, family background, and social environment on the formation of his character. Although these factors are not directly reflected in the characters' lines and actions, they play a crucial role in shaping the characters' personalities. With a deep understanding of these factors, the actor can better grasp the character development vein of the character, so as to show the character's personality characteristics more naturally in the performance ^[1].

It is worth noting that the actor should also pay attention to the character's personality change and growth when exploring the character's personality. In a drama, many characters' personalities change as the story progresses. Actors need to accurately grasp these changes and present the growing process of the characters to the audience with delicate performances. This not only requires actors to have solid acting skills, but also deep emotional experience and a keen ability to capture emotions. Only in this way can actors create character images with depth and layers on stage, allowing the audience to enjoy the drama while also feeling the charm of the characters' personalities and the appeal of art ^[2,3].

2.2. The delicate expression of the characters' emotions

In dramatic performance, the delicate expression of the character's emotions is an important yardstick to measure the artistry of character creation. Actors need to accurately capture and delicately convey the emotional fluctuations of characters in different situations, which requires actors not only to have rich emotional experience and perception, but also to flexibly use voice, body movements, facial expressions, and other means of expression to vividly present the inner world of characters. Delicate emotional expression is reflected in the accurate grasp of the character's emotions. An actor needs to deeply analyze the root of a character's emotions and understand his or her psychological state under a specific plot background, so as to truly reveal his or her emotions. For example, when facing a sad scene, an actor should show the character's external crying or silence, but also pay attention to details such as the hollow eyes and trembling voice, to convey the character's inner pain and despair. In this process, actors also need to pay attention to the layers and coherence of emotional expression, to ensure that the characters' emotions transition naturally with the development of the plot, and to avoid abrupt emotional changes affecting the audience's watching experience ^[4].

Delicate emotional expression also needs to focus on resonating with the audience. In the process of performance, actors should strive to find emotional commonalities with the audience and trigger the emotional resonance of the audience with a true and natural performance. This requires actors to pay attention to the emotional state of the role during the performance as well as to the reaction of the audience, timely adjust the performance rhythm and emotional intensity, to ensure that the delicate expression of the role's emotions can be accurately conveyed to the audience and trigger its deep emotional resonance. With such exquisite expression, the role shaping in dramatic performance will be more three-dimensional and fuller, and the artistic appeal will also be significantly improved ^[5,6].

2.3. The logical construction of character behavior

The character's behavior reflects his personality and inner world, and also promotes the development of the plot. Therefore, during the performance process, the actor must deeply understand the character, accurately grasp the logical motivation behind his behavior, and ensure that every action and decision is in line with the character's personality settings and situational needs ^[7].

On the one hand, the main task of logical construction is to clarify the motivation of the character's behavior. Actors need to analyze the character's situation, goals, and relationship with other characters in the script to deduce the reasonable motivation behind his or her behavior. For example, when a greedy character faces the temptation of profit, the logic of his behavior should be to pursue his own interests at all costs; an upright character, on the other hand, may stick to his principles and refuse temptation. An actor should be able to accurately capture these motivations when acting and translate them into the character's specific behavior with a delicate performance.

On the other hand, the logical construction of the character's behavior also needs to pay attention to coherence and rationality. In a dramatic performance, a character's behavior should be consistent with the development of the plot, and abrupt or illogical behavior should be avoided. During the performance, actors should always pay attention to the changes of the character's psychological state and external environment, and adjust the character's behavior flexibly according to these changes, so as to ensure that their behavior not only conforms to the character's personality characteristics, but also promotes the reasonable development of the plot. Such logical construction makes the characters in the drama performance more three-dimensional and real, and the audience can better understand and feel the inner world of the characters ^[8-10].

3. The skills of role shaping in dramatic performance

3.1. The use of sound skills

The change of the actor's voice can convey the role's emotional state, personality characteristics, and identity background. First of all, the level and speed of the voice can directly reflect the emotional changes of the character, such as a high and rapid voice when excited, and a low and slow voice when sad. Actors need to adjust their intonation flexibly according to the emotional ups and downs of the characters, so that the emotions of the characters can be truly revealed. Secondly, the use of timbre is also an important means to shape the image of the role. Different timbres can create different role images, such as a low and gravelly timbre suitable for shaping a calm and restrained role, while a crisp and pleasant timbre is suitable for shaping a lively and cheerful role. Finally, the use of dialect and accent can also add a unique identity background to the role, making the role more vivid and three-dimensional. In the process of performance, actors should accurately grasp the language characteristics of the role, and use the cadence of the voice, the change of timbre, and the dialect accent to depict the role image delicately, so as to enhance the artistic appeal of the drama performance. Therefore, the use of voice skills is an indispensable part of role shaping in dramatic performance, which requires actors to have profound phonetic skills and keen emotional perception ^[11].

3.2. Body control skills

The actor's precise body language can vividly convey the mood, personality, and state of the role. The maintenance of the body is the basis, actors need to adjust their standing, sitting, and walking posture according to the role's identity, personality, and emotional state, in order to show the unique temperament of the role. The use of body movements should be expressive and logical, every minute action should serve the role of

emotional expression and plot advancement, to avoid excessive exaggeration or blunt unnaturalness. Facial expression is an indispensable part of body control, which is directly related to the transmission of characters' emotions. Actors need to use subtle changes such as the movement of the eyes and the curvature of the mouth to delicately express the inner world of the characters and realize the three-dimensional shaping of the role image, so that the audience can resonate with the characters both visually and emotionally, thus enhancing the artistic effect of dramatic performance^[12].

3.3. The processing skills of lines

The actor's accurate grasp and vivid interpretation of the lines can deeply reveal the character's personality characteristics and emotional state and promote the development of the plot. Therefore, drama actors need to deeply understand the connotation of the lines, grasp their emotional colors and subtext, and ensure that the thoughts, emotions, and intentions of the characters can be accurately conveyed in the interpretation. When reading lines, actors should pay attention to the change of speech speed and intonation, according to the character characteristics and emotional ups and downs of the role, flexible use of speed, high and low, light and other phonetic skills, so that the lines are full of rhythm and appeal.

In addition, the handling of lines should also pay attention to the coordination and cooperation with other performance elements. When performing, actors should closely combine their lines with body movements and facial expressions to form a complete performance system. For example, when expressing strong emotions such as anger or sadness, actors can use exaggerated expressions of body movements and facial expressions, combined with powerful line reading, to make the emotional state of the character more vivid and prominent. At the same time, actors also need to pay attention to the cohesion and echo of the dialogue between the lines and other characters to ensure the continuity and logic of the plot. The actors' precise handling of the lines and coordination with other performance elements can create a more three-dimensional and vivid role image, so that the audience can deeply feel the charm of the characters and the connotation of the story while enjoying the drama performance^[13].

4. A case study on the integration of artistry and skill in role shaping in dramatic performance: Taking Yu Ji's role shaping in *Farewell My Concubine* of Peking Opera as an example

Among the traditional Chinese operas, Peking Opera, with its unique artistic charm and profound cultural deposits, has become a treasure of traditional Chinese culture. *Farewell My Concubine*, as a classic opera in Beijing Opera, shows the historical background and conflict of the Chu and Han dynasties. Moreover, through the role of Yu Ji, it deeply reveals the complexity of human nature and the entanglement of emotions. The following will take Yu Ji's role shaping as an example to explore the integration of artistry and skill of role shaping in dramatic performance.

4.1. Role background and artistic orientation

Yu Ji, as the heroine in *Farewell My Concubine*, is Xiang Yu's beloved concubine. She is also a woman with outstanding talent and a profound sense of justice. In the play, the image of Yu Ji is endowed with high artistic value. She is Xiang Yu's emotional sustenance and spiritual pillar. Therefore, when creating the role of Yu Ji, the actor needs to accurately grasp her complex and changeable inner world as well as the deep emotional bond between her and Xiang Yu.

4.2. The integration of artistry and skill

4.2.1. Artistic treatment of singing and speaking

Peking Opera is famous for its unique singing style and intonation. In *Farewell My Concubine*, Yu Ji's singing style and intonation show her delicate emotional world and noble character. In the performance of Yu Ji, the actor should pay attention to the combination of the gentleness of the singing and the emotion of the intonation. With delicate voice control and emotional input, Yu Ji's deep friendship with Xiang Yu, as well as her helplessness and determination in the face of separation and death, are vividly displayed. In terms of singing, the actress can use the "Mei School" singing style in Beijing Opera to show Yu Ji's elegant temperament and deep friendship with its fresh and refined features and full charm. As for the intonation, they should pay attention to the cadence of the voice and the fluctuation of emotions, so that each sentence of Yu Ji is full of appeal and can directly strike the audience's heart ^[14].

4.2.2. Delicate depiction of physical movements and facial expressions

Beijing Opera performance pays attention to the four skills and five methods of "singing, reading, and fighting," in which physical movements and facial expressions are important means to shape the role image. In *Farewell My Concubine*, Yu Ji's physical movements and facial expressions are endowed with high artistic value. The actor needs to show Yu Ji's inner emotional fluctuations and personality characteristics through the delicate depiction of her speech, mantras, and eye movements. In terms of physical movements, the actress can learn from the elegant gestures of ancient women and combine the figure performance in Beijing Opera to vividly show Yu Ji's softness and tenacity. In terms of facial expression, the actress needs to use subtle changes such as the movement of eyes and the curvature of the mouth to convey Yu Ji's inner joy, sadness, and determination ^[15].

4.2.3. The auxiliary role of costumes, makeup, and props

In Beijing Opera performances, costumes, makeup, and props are indispensable elements in shaping the characters' images. In *Farewell My Concubine*, Yu Ji's costumes are mainly gorgeous and elegant, reflecting not only her noble status but also her pursuit of beauty. In terms of makeup, the actors need to use the unique makeup techniques of Peking Opera, such as "patch" and "hair cut," to show Yu Ji's beautiful face and demure temperament. Props, such as swords and fans, became important carriers for Yu Ji to express her emotions and talents.

5. Conclusion

Through the discussion of the role shaping in the drama performance, the importance of combining artistry and skill is fully demonstrated. The in-depth exploration of characters' personalities not only requires actors to have a deep understanding of the characters' background and psychology, but also requires them to accurately present the characters' emotional and behavioral changes on stage. The delicate expression of emotions and the logical construction of behaviors are the keys to the realistic and layered sense of a role, and voice, body, and line skills are effective means to convey all of them. The role of Yu Ji in the Peking Opera *Farewell My Concubine* fully demonstrates the complexity and artistry of dramatic performance. Through her unique singing, physical movements, and facial expressions, the actress vividly presents the inner world of the role, which enhances the appeal of the play.

This combination of artistry and skill not only requires actors to have a solid performance foundation but also requires them to constantly explore and innovate in practice, so as to present a richer artistic experience for the audience. Every successful role creation cannot be separated from the actor's persistent pursuit of art and

deep understanding of the role. In the end, through the combination of art and skill, dramatic performance not only shows the multi-dimensional personality of the characters but also brings the audience into an artistic space full of emotions and thoughts.

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Research on the Innovative Path of Coordinated Development of Medical Graduate Research and Clinical Training under the Dual-Track Integration Mode

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Abstract: This study, based on the current status and challenges of medical graduate education, explores innovative pathways for the coordinated development of research and clinical training under a dual-track integration model. By analyzing survey data and integrating cutting-edge educational concepts, a series of specific reform recommendations is proposed. The aim is to promote the upgrading and innovation of medical graduate training models, facilitate the integration of clinical practice and research, and provide strong support for the comprehensive development of medical graduates.

Keywords: Medical graduate students; Dual-track integration mode; Scientific research and clinical collaboration; Education innovation

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1. Research background and problem analysis

1.1. Trends in international medical education reform

Medical graduate education has always been a significant topic in the reform of medical education. In recent years, scholars both domestically and internationally have actively explored reform paths. For example, the “Physician Scientist” training model in the United States achieves deep integration of basic research and clinical practice through interdisciplinary courses (such as Harvard Medical School’s “Translational Medicine” program), with 35% of its graduates possessing both clinical practice qualifications and independent research capabilities^[1]. The UK’s “Academic Foundation Programme” requires resident physicians to complete research projects before they can be promoted, forming an evaluation system that equally emphasizes research ability and clinical skills.

1.2. The dilemma of the integration of domestic dual tracks

The traditional model of medical graduate education suffers from issues such as the disconnect between research and clinical practice and an excessively long training period. Especially under the “5+3” model, clinical rotations dominate, leaving insufficient time for research training, which leads to low-quality papers and frequent psychological problems ^[2]. To address these challenges, this study proposes an innovative “pre-undergraduate preparatory program” model, where students enter their mentors’ research groups six months before graduation to undergo preparatory research training. By optimizing the curriculum, mentorship mechanisms, and practical components, we aim to explore a dual-track integrated training path, providing new ideas for the reform of medical graduate education. This model is designed to allow students ample time for research training before clinical rotations, thereby enhancing their research and innovation capabilities. Through the design and implementation of surveys, we analyze students’ needs and feedback on this model, hoping to discover a dual-track integrated training path that enables medical graduates to achieve comprehensive development through the integration of research and clinical practice, advancing the model of medical graduate education.

Under the current “5+3” training model, data from a top-tier hospital shows that specialized master’s students work an average of 58 hours per week in clinical settings, leaving only 4.6 hours for research training. This results in 82% of students’ thesis data coming from retrospective case analysis. More alarmingly, among ultrasound medicine specialists, only 23% complete their research projects on time, with significantly weaker research and innovation capabilities compared to academic master’s students.

2. Innovation paths of the training system

2.1. Constructing a three-dimensional interdisciplinary curriculum system

In the training process of medical graduate students, constructing an interdisciplinary curriculum system is crucial for enhancing their overall quality and innovative capabilities ^[3]. According to survey data, about 54% of students choose to rotate in departments during their internships, 30% opt to conduct research projects with their mentors while rotating in departments, and approximately 16% choose to work on research projects with senior students in the group. This indicates a high demand for interdisciplinary knowledge and practical experience among students. Therefore, developing a series of interdisciplinary courses, such as “Comprehensive Medical Practice,” which covers clinical medicine, basic medicine, and research methods, can meet the diverse disciplinary needs of students.

2.2. Strengthening the integration of basic scientific research methods and clinical applications

To cultivate medical graduate students with research literacy and clinical practice skills, it is particularly important to strengthen the integration of basic research methods and clinical applications in courses ^[4]. Survey results show that about 76% of students hope to gain independent research learning abilities under the “4.5+3.5” training model, approximately 59% wish to improve their data analysis skills, and around 55% aim to enhance their literature search and reading abilities, indicating high expectations for the cultivation of research skills among students. Therefore, designing a course on “Integration of Basic Research Methods and Clinical Applications” aims to teach fundamental research knowledge and apply it to clinical practice, thereby enhancing the combination of students’ research capabilities and clinical practice skills.

2.3. Offering interdisciplinary team cooperation practice courses

Interdisciplinary team collaboration practice courses are of great significance for promoting the coordinated development of medical graduate research and clinical practice. Approximately 46% of students wish to participate in research projects, indicating a high demand for team collaboration practices. Therefore, offering “Interdisciplinary Team Collaboration Practice” courses allows students to solve medical problems within teams, fostering their teamwork awareness and problem-solving skills ^[5]. Such practical courses will help students apply their knowledge in real-world scenarios, enhancing their overall competence.

3. Mentor guidance and practical training

3.1. Establishing a two-way selection mechanism for the mentor system

In the process of training medical graduate students, establishing a two-way selection mechanism for the mentor system is a crucial step in improving educational quality. This helps achieve precise matching between mentors and students, thereby promoting personalized development and overall improvement of graduate students. Survey data shows that about 68% of students indicate that their mentors’ guidance on learning methods is critical, and 76% of students believe that their mentors’ guidance on professional competence is essential. This indicates a high demand for mentor guidance from students. Therefore, we can establish a two-way selection mechanism for the mentor system, which means mutual selection between students and mentors ^[6]. Students can choose suitable mentors based on their interests and career plans, while mentors can select appropriate students based on their academic background and research capabilities. Such a two-way selection mechanism will better facilitate interaction and cooperation between students and mentors, enhancing the effectiveness of guidance.

3.1.1. Construction of a two-way selection platform

Technical support: The development mentor-student intelligent matching system is developed to analyze the matching degree of research interests between both sides based on natural language processing technology. After the application to a university in Chongqing, the satisfaction with mentor guidance increased from 68% to 89%.

3.1.2. Collaborative training by two mentors

Institutional innovation: Establish a joint ward round system between scientific research mentors and clinical mentors, and conduct “bedside research problem discussion” for 2 hours every week to transform clinical observation into research topics ¹³. Data from Peking Union Medical College Hospital show that this mode increases the efficiency of clinical cases to transform into research topics by 3.2 times ^[7].

3.2. Optimization of the practice system

3.2.1. Optimizing the linkage training mechanism between scientific research mentors and clinical mentors

Optimizing the collaborative training mechanism between research mentors and clinical mentors is an indispensable part of medical graduate education. It can effectively promote the deep integration of research and clinical teaching, providing strong support for cultivating well-rounded medical professionals ^[7]. Survey data shows that about 54% of students choose to rotate in departments during their internships, while 30% opt to follow their mentors on research projects while rotating in departments. This indicates that students need better integration between clinical practice and research learning. Therefore, we can optimize the

collaborative training mechanism between research mentors and clinical mentors, establishing a two-way mentorship system^[8]. Research mentors are responsible for guiding students in research projects, while clinical mentors guide students in clinical practice. Information sharing and communication between the two ensure that students receive comprehensive guidance and training in both research and clinical areas. Such a collaborative training mechanism will help enhance students' overall research and clinical capabilities.

3.2.2. Scientific research and practice innovation

Project design: A “clinical problem-oriented” research fund was set up, requiring that the projects must be based on unsolved problems proposed by clinical departments. Among the 23 projects funded in the first year of a hospital in Wuhan, 8 achievements have been realized in clinical transformation.

3.2.3. Strengthening clinical skills

Advanced training: A three-level training system of “standardized patient-simulated surgery-real surgery” was constructed, and minimally invasive surgery training was carried out using the Da Vinci surgical robot simulator, which reduced the incidence of complications in the first operation by 42% for graduate students.

3.3. Implementing the training program of cross-field scientific research and clinical practice under the guidance of tutors

Implementing mentor-led interdisciplinary research and clinical practice training programs is a crucial approach to enhancing the overall quality and innovation capabilities of medical graduate students, facilitating the organic integration of research and clinical practice, and promoting the innovative development of medical graduate education^[9]. Approximately 76% of students express a desire for research self-learning skills under the “4.5+3.5” training model, 59% hope to improve their data analysis skills, and 55% wish to enhance their literature search and reading abilities. Therefore, we can implement mentor-led interdisciplinary research and clinical practice training programs, fostering close collaboration with mentors to ensure that students complement each other in both research and clinical practice, mutually reinforcing one another. Through such training programs, students can participate in interdisciplinary research projects under the guidance of their mentors, engage in clinical practice^[10], and apply research outcomes to clinical settings, thereby comprehensively improving their research and clinical capabilities.

4. Strengthening scientific research practice and clinical practice

4.1. Carrying out scientific research and innovation projects

In the training process of medical graduate students, conducting research innovation project practices is crucial. By guiding students to participate in research projects, not only can their understanding of cutting-edge knowledge in the medical field be deepened, but also their spirit of scientific exploration and practical skills can be cultivated. Through practice, students can personally experience the entire process of research, from topic selection, design, implementation to data analysis and paper writing; each step is a comprehensive exercise of their research capabilities. According to survey data, about 76% of students hope to enhance their independent research learning abilities in the “4.5+3.5” training model, and 61% of students express a desire for more research practice opportunities. Therefore, we can meet students' needs by conducting research innovation project practices. The school can organize a series of research projects, including basic and applied research, to carry out innovative studies in the medical field^[11]. By involving students in research projects, their research

thinking and innovation capabilities can be cultivated, improving their research level and practical skills.

4.2. Deepening the content and requirements of clinical practice

Clinical internships are a crucial component of medical graduate education. By deepening the content and requirements of clinical internships, students' practical clinical skills can be further enhanced. During the internship, students should fully participate in clinical diagnosis and treatment activities through observation, operation, discussion, and other methods to deepen their understanding and knowledge of diseases. At the same time, schools should strengthen supervision and guidance on clinical internships to ensure their quality and effectiveness. Survey data shows that about 54% of students choose to rotate through departments during their internship, while 30% opt to follow mentors on research projects alongside department rotations. Therefore, we can deepen the content and requirements of clinical internships to better align with students' career planning and future development needs. Schools can increase the duration and frequency of clinical internships, expand the scope of internships, enrich internship content, introduce advanced medical technologies and treatment methods, and improve students' clinical practice abilities and their capacity to handle complex cases.

4.3. Establishing an “integrated” evaluation system for scientific research practice and clinical practice

To comprehensively evaluate the overall quality of medical graduate students, an “integrated” evaluation system combining research practice and clinical internship should be established. This system should take into account students' performance in both research and clinical internships, including their research capabilities, clinical skills, innovative thinking, teamwork, and more. Through this evaluation system, a more comprehensive reflection of students' abilities and potential can be achieved, providing more targeted guidance for their future development ^[12]. For the performance of students in research practice and clinical internships, an “integrated” evaluation system combining research practice and clinical internship should be established. This evaluation system should consider multiple factors, such as students' performance in research projects, research outcomes, clinical skills, and medical service capabilities during clinical internships, to comprehensively assess their research and clinical abilities. The establishment of this evaluation system will help promote the organic integration of research practice and clinical internships, stimulate students' enthusiasm for learning and innovation, and enhance their overall quality and competitiveness.

5. Implementation results and improvement direction

5.1. Stage achievements

Data from pilot institutions in Chongqing (2023–2024) show that the number of SCI papers published increased by 65% year on year; the excellent rate of clinical skills assessment increased to 82%; and the depression scale score of students decreased by 41%.

5.2. Existing challenges

Insufficient faculty collaboration: Only 38% of clinical mentors regularly participate in the research group; Imbalanced resource allocation: The peak period of use of the research laboratory queues up for 3.6 hours; Single evaluation criteria: 76% of students believe that the current evaluation does not reflect interdisciplinary ability.

5.3. Optimization suggestions

- (1) Establish a mentor collaborative performance management system, and incorporate the results of dual mentor cooperation into the professional title evaluation index.
- (2) The intelligent reservation system for laboratories has been implemented, and the opening time of key platforms has been extended to 22:00.
- (3) Develop a multi-dimensional evaluation and certification system based on blockchain technology to realize the whole process of capability growth traceability.

6. Conclusion

This study delves into the issue of disconnection between research and clinical training in current medical graduate education, proposing an innovative path under a dual-track integration model. The aim is to achieve an organic combination of research and clinical education, thereby enhancing the overall quality of medical graduates. By introducing a preparatory program that allows students to join their mentors' research groups six months before they officially start clinical rotations, students can gain sufficient time for research training before formally entering clinical rotations, thus improving their research and innovation capabilities. Combining survey data with cutting-edge educational concepts, this paper offers specific suggestions for integrating the curriculum system, optimizing mentorship mechanisms, and strengthening research and clinical practice. Implementing these reform measures can effectively promote the coordinated development of research and clinical practice among medical graduates, enhancing their competitiveness and comprehensive qualities in both research exploration and clinical practice. Looking ahead, this innovative training model will provide new directions and impetus for medical graduate education, ensuring the cultivation of high-level medical professionals with research literacy and clinical skills.

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Research on the Integration of Sichuan's Red Culture into Ideological and Political Theory Courses in Higher Education Institutions

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Abstract: As an integral component of China's revolutionary culture, Sichuan's red culture, with its abundant historical resources and distinctive regional characteristics, provides high-quality educational materials for ideological and political education in higher education institutions. The integration of Sichuan's red culture into university ideological and political education demonstrates both theoretical necessity and practical feasibility, having already yielded remarkable outcomes. This integration must adhere to the principle of unifying teacher guidance with student initiative, comprehensive coverage with focused emphasis, and cultural inheritance with innovative development, thereby fully realizing the educational value of Sichuan's red culture in collegiate ideological and political education.

Keywords: Sichuan red culture; Colleges and universities; Ideological and political theory course

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1. The connotation of Sichuan red culture

There are multiple perspectives on the definition of the connotation of "red culture" in the academic community. From a semantic perspective, the concept of "red" has been given special political connotations in the context of modern Chinese history. Some scholars pointed out: "With the construction of the revolutionary discourse system, red has gradually become a symbol of the revolutionary regime, and the party's regime is called the red regime. Based on this, red culture can be defined as the sum of material and spiritual civilization created by revolutionary practice in a specific historical period" ^[1]. Other scholars, starting from cultural ontology, believe that "red culture is essentially a collection of material and spiritual achievements formed by the Chinese Communist Party in leading the people in the historical process of realizing national independence and national prosperity" ^[2]. Overall, red culture constitutes the dialectical unity of the material and spiritual civilization of the Chinese Communist Party during the period of revolution and construction. As for the specific connotation of Sichuan red culture, the academic community's understanding presents a multi-dimensional feature.

Some studies define it as a unique cultural resource system formed by the Communist Party of China since its founding in the revolutionary struggle (1921–1949), socialist construction (1949–1978), and reform and opening up (1978–present) in Sichuan, including both concrete material remains and abstract spiritual values ^[3].

Combining the views of various scholars, Sichuan red culture, as a part of red culture, has the general characteristics of red culture, and at the same time has its own special regional characteristics. It refers to the red culture that originated in Sichuan, has distinct regional characteristics, and is shared by the people of Sichuan. It refers to the sum of various achievements formed after the late 19th century during the Railway Protection Movement, the Great Revolution, the Land Revolution, the Anti-Japanese War, the Liberation War, the Third Line Construction, the New Period of Reform and Opening Up, and the New Era. It embodies the revolutionary spirit and practical wisdom of the Communist Party of China and the people of Sichuan, and is concentrated in the spirit of fearlessness of hardship, courage to move forward, bravery and tenacity, sacrifice one's life, unity, and solidarity.

2. The necessity of integrating Sichuan red culture into ideological and political courses in colleges and universities

2.1. The need to improve the effectiveness of ideological and political theory courses in colleges and universities

The survey shows that the current ideological and political theory courses in colleges and universities have problems such as a dull classroom atmosphere, repetitive teaching content, and single teaching methods, which lead to negative emotions in some students. Sichuan red culture, as a high-quality teaching resource, has unique advantages in improving the attractiveness of ideological and political courses. First, local red stories can effectively improve the classroom atmosphere. For example, by telling revolutionary stories with Sichuan characteristics such as “Wang Baochang,” it can not only mobilize the classroom atmosphere in a vivid and humorous way, but also guide students to understand the profound connotation of revolutionary history through appearances. Secondly, Sichuan red cultural resources are diverse, covering revolutionary historical events, heroic deeds, the spiritual spectrum, and other dimensions, providing rich and non-repetitive teaching materials for ideological and political courses. Finally, based on the practical characteristics of red culture, teachers can adopt diversified methods such as situational teaching and field trips to organize visits to revolutionary sites, celebrity residences, and other places, and organically combine theoretical teaching with practical experience. This teaching model that incorporates local red culture can not only stimulate college students' interest in learning but also significantly improve the effectiveness of ideological and political education, and provide an effective path to solve the current dilemma of ideological and political teaching.

2.2. The inherent requirements for consolidating the main ideological position

The purpose of propaganda and ideological work is to consolidate the guiding role of Marxism in the ideological field. Ideological work is related to the future and destiny of the party and the country, and is related to the cohesion and centripetal force of the nation. As the forefront of ideological work, colleges and universities must firmly grasp leadership. As an important part of revolutionary culture, the integration of Sichuan red culture into the ideological and political education of colleges and universities has three strategic significances: first, it is an important carrier for consolidating the guiding position of Marxism, and red cultural education can strengthen students political identity; second, it is a powerful weapon to resist erroneous thoughts, and through the vivid display of revolutionary history, it can refute erroneous views such as historical nihilism; finally, it is

an effective way to cultivate new people of the times, and through the inheritance of red genes, it can build a solid foundation for students' ideals and beliefs.

Carrying out Sichuan red cultural education in depth is not only a concrete practice to implement the requirements of carrying out in-depth education on China's excellent traditional culture, revolutionary culture, and advanced socialist culture, but also a strategic measure to firmly grasp the leadership of ideological work in colleges and universities. By systematically integrating Sichuan's red cultural resources and innovating educational methods, we can effectively enhance the persuasiveness and appeal of ideological education, enable college students to strengthen their "four confidences" under the influence of red culture, and become new people of the era who shoulder the great responsibility of national rejuvenation.

2.3. The need to cultivate cultural confidence and enhance political identity

The university stage is a critical period for shaping the political identity of young people. At present, the ideological and political theory courses in colleges and universities face three challenges: first, there is a tendency to "focus on theoretical teaching and neglect value guidance" in course teaching; second, in the context of the Internet era, the infiltration of non-mainstream thoughts such as historical nihilism has intensified; third, foreign ideology continues to be imported in a covert way. These factors pose a severe test for the formation of the correct political identity of college students.

The 20th National Congress of the Communist Party of China pointed out that "to comprehensively build a modern socialist country, we must adhere to the development path of socialist culture with Chinese characteristics and enhance cultural confidence"^[4]. The cultural confidence of the Chinese nation is rooted in three major cultural sources: the excellent traditional culture that has lasted for 5,000 years, the red culture nurtured by the party leading the people in the revolutionary struggle, and the advanced culture formed in the practice of building socialism with Chinese characteristics. The cultivation of this cultural confidence requires a progressive process from cognition to identification. Integrating Sichuan's red culture system into the ideological and political theory curriculum system of colleges and universities has important educational value: first, through historical narrative and spiritual interpretation, it deepens students' understanding of the historical origins and value connotations of red culture; second, with the help of emotional edification and value guidance, it promotes the formation of a conscious identification with red culture among students; third, based on the dual foundation of cognition and identification, it cultivates students' ability to distinguish and political determination when facing multiculturalism. Practice has shown that students' understanding of red culture is positively correlated with cultural confidence. Therefore, strengthening red culture education through curriculum integration can not only enhance students' cultural identity but also improve their clear cultural awareness and firm political stance in the promotion of multiculturalism.

3. The feasibility of integrating Sichuan red culture into the ideological and political courses of colleges and universities

3.1. Sichuan red cultural resources are highly consistent with the educational goals of ideological and political courses in colleges and universities

There is a multi-dimensional internal consistency between Sichuan's red cultural resources and ideological and political theory courses in colleges and universities, which constitutes the logical basis for cultural integration into education. In terms of the isomorphism of value goals, the ideological and political courses in colleges and universities take the establishment of morality and cultivation as their fundamental tasks, and strive to cultivate

new people of the era who are responsible for the great task of national rejuvenation. The spiritual spectrum contained in Sichuan's red culture, from the spirit of the Sichuan-Shaanxi Soviet Area to the spirit of "two bombs and one satellite," from the spirit of earthquake relief to the spirit of poverty alleviation, all deeply reflect the ideals, beliefs, and moral pursuits of the Chinese Communists. In terms of the homology of theoretical foundations, the two are rooted in the Marxist theoretical system. The ideological and political theory courses in colleges and universities are based on the basic principles of Marxism, and the formation and development of Sichuan's red culture have always followed the practical path of the sinicization and modernization of Marxism.

3.2. Red resources are rich and valued, welcoming development opportunities

Sichuan, as a region rich in red cultural resources, has significant advantages in the reserve of red cultural resources. From the perspective of resource composition, it mainly includes three types of important historical relics: one is the series of battle sites formed during the expansion of the Sichuan-Shaanxi Soviet base; the second is the important meeting sites left behind when the Workers and Peasants Red Army passed through Sichuan during the Long March; the third is the former residences and memorial sites of revolutionary predecessors represented by Deng Xiaoping, Zhu De, Huang Jiguang, etc. From the perspective of development conditions, Sichuan has three favorable factors: one is the unique geographical environment and cultural heritage; the second is the densely distributed higher education resources; the third is the local governments' high attention to ideological and political education, and the continuous promotion of red cultural resource development through special research activities. In addition, local students have a natural affinity for Sichuan red culture, which provides a good audience base for cultural inheritance. These conditions together constitute the unique advantage of Sichuan red culture in integrating ideological and political education in colleges and universities.

4. Principles of integrating Sichuan red culture into ideological and political courses in colleges and universities

The core value of Sichuan red culture is highly consistent with the purpose of ideological and political education in colleges and universities. Giving full play to the unique educational function of Sichuan red culture will help solve its difficulties in the integration process. In terms of the integration principle, the integration of red culture and ideological and political courses should be achieved by adhering to the unity of dominance and subjectivity, the unity of the principle of fullness and prominence, and the unity of inheritance and innovation.

4.1. The unity of the principle of dominance and subjectivity

The integration of Sichuan red culture into ideological and political theory courses in colleges and universities should follow the teaching principle of the unity of teacher dominance and student subjectivity. The General Secretary clearly pointed out: "The teaching of ideological and political theory courses should adhere to the unity of dominance and subjectivity. It is necessary to give full play to the leading role of teachers, and to deeply study the cognitive laws and acceptance characteristics of students, and give full play to the subjective role of students" ^[5]. This important statement provides a fundamental basis for the integration of red cultural resources into ideological and political courses.

From the perspective of teaching subject, student subjectivity is reflected in three aspects: first, autonomous construction at the cognitive level, students can selectively internalize teaching content based on their own thinking patterns; second, conscious participation at the practical level, students actively practice the value

orientation of course delivery; third, natural identification at the emotional level, students resonate with red culture from the heart. This requires that the integration of Sichuan red culture must focus on the vividness of teaching methods, the affinity of teaching content, and the interactivity of the teaching process, so that students can achieve the unity of knowledge acquisition and literacy improvement through deep participation.

From the perspective of teacher-led, the teacher-led role is mainly reflected in four aspects: first, the professionalism of resource screening, which can select typical cases with the most educational value, characteristics of the times, and regional characteristics from the rich Sichuan red cultural resources; second, the forward-looking nature of teaching design, innovative integration methods, and the transformation from simple embedding to deep integration; third, the appropriateness of process guidance, giving positive guidance on the basis of respecting students cognitive laws; fourth, the scientific nature of effect evaluation, timely correcting cognitive biases, and ensuring the correct direction of red cultural education.

This dialectical unity of dominance and subjectivity not only avoids the drawbacks of “one-way indoctrination” in traditional teaching, but also prevents the laissez-faire “formalism” tendency, making Sichuan’s red culture a real source of nourishment for students’ political literacy and achieving an educational effect of “entering the minds and hearts.”

4.2. The unity of the principles of comprehensiveness and emphasis

The integration of Sichuan red culture into the ideological and political theory courses of colleges and universities needs to adhere to the principle of the unity of comprehensiveness and emphasis. The principle of comprehensiveness requires that the red cultural elements be integrated into the entire teaching process, from pre-class preparation, classroom teaching to post-class evaluation, and at the same time, a synergistic effect is formed in the first classroom of theoretical teaching and the second classroom of practical experience, creating a comprehensive red cultural education atmosphere. The principle of emphasis emphasizes that, according to the key points and difficulties of the teaching content and the cognitive characteristics of the students, the appropriate red cultural resources should be accurately selected, and the key teaching nodes should be strengthened to avoid simple piling and mechanical indoctrination. The dialectical unity of the two is reflected in the need to maintain the systematicity and coherence of red cultural education, to pay attention to the appropriateness and pertinence of teaching implementation, and to achieve the organic integration of knowledge imparting and value guidance through scientific teaching design. This unity is in line with the laws of education and teaching, and can improve the actual effect of red cultural education, so that students can grasp its spiritual essence and contemporary value while systematically accepting the influence of red culture, and ultimately achieve the educational goal of cultivating souls and educating people.

4.3. The unity of inheritance and innovation

The integration of Sichuan red culture into the ideological and political theory courses of colleges and universities must adhere to the principle of the unity of inheritance and innovation. Inheritance requires respecting the original appearance of history, deeply exploring the spiritual core and regional characteristics of Sichuan red culture, maintaining its cultural authenticity in teaching, and giving full play to its educational value as a result of the practice of Marxism in China. Teachers should systematically sort out Sichuan red cultural resources with a rigorous academic attitude and accurately explain their historical context and spiritual essence. At the same time, innovation emphasizes the need to base on the development of the times, use new media technology and modern teaching methods, and make red cultural education more vivid through interactive

forms such as scenario simulation and virtual reality. It is necessary to focus on combining the spirit of red culture with the cognitive characteristics of contemporary college students, develop teaching cases and practical activities with contemporary characteristics, and realize the organic integration of the essence of traditional education and modern teaching methods. This dialectical unity of inheritance and innovation not only ensures the seriousness and accuracy of red cultural education, but also enhances the attractiveness and appeal of teaching, so that students can internalize the red spirit into their own value pursuit and code of conduct on the basis of understanding history, and ultimately realize the contemporary value of red cultural education.

5. Conclusion

Sichuan red culture, as a national cultural imprint with regional characteristics and rich connotations, has valuable educational value and is an important educational and teaching resource for college ideological and political courses. By exploring the connotation of Sichuan red culture, clarifying its value and significance, and implementing the integration principle, the study hopes that Sichuan red culture can be better integrated into the ideological and political theory courses of colleges and universities, achieve the goal of cultivating morality and educating people, and cultivate qualified builders and reliable successors for the construction of socialism with Chinese characteristics.

Disclosure statement

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Optimizing Vocabulary Acquisition for Chinese Students in Rural-Urban Fringe Areas through Learning Strategies

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Abstract: The interplay of academic atmosphere, learning motivation, and strategies inherently influences English learning. Effective vocabulary acquisition strategies significantly influence the achievements of English acquisition. Vocabulary mastery, a cornerstone of middle school English education, raises a critical question: How can vocabulary strategies optimize students' memory, understanding, and vocabulary application? This article elaborates on the importance and characteristics of vocabulary learning in Chinese junior high schools, analyzes definitions and theories of learning strategies, and proposes specific vocabulary approaches tailored to junior high school students in rural-urban fringe areas.

Keywords: Academic atmosphere; Learning motivation; Vocabulary learning strategies; Vocabulary memorization skills; Vocabulary learning strategy training

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1. Introduction

Proverbs like “A journey of a thousand miles begins with a single step” emphasize the foundational nature of vocabulary accumulation, which is also essential to effective communication. Wilkins asserts the importance of precise and unambiguous vocabulary ^[1]. Efficient vocabulary acquisition is achieved through “learning strategies,” defined as observable behaviors and internal cognitive activities ^[2], and is the ideal regulation learning process ^[3].

Chamot and O'Malley argued that the integration of multiple learning strategies involves specific thoughts or behaviors that learners use to comprehend, process, or retain new information. Compared to primary school, junior high school students are marked by significantly larger vocabulary requirements ^[3]. According to the Chinese National English Curriculum Standards for Compulsory Education, junior high school graduates are expected to master 1,500–1,600 words and 200–300 fixed expressions, making vocabulary acquisition an indispensable component of junior high school English education ^[4].

2. Current status of English vocabulary learning in rural-urban fringe schools

Traditional vocabulary teaching methods still dominate vocabulary instruction in many schools in China. Teachers devote excessive time to explaining words in isolation, disregarding their connections within a broader linguistic context. Moreover, limited attention is given to guiding students in adopting effective vocabulary learning strategies, such as utilizing acquired knowledge to understand and internalize new words. Cognitive and memory strategies are frequently neglected, leaving students reliant on rote learning that fails to support long-term retention or practical application.

The most common approach to vocabulary instruction involves a standardized five-step process: first, the teacher introduces the new words through oral reading, followed by students repeating practice; third, the teacher explains the usage of key vocabulary, after which, students are expected to memorize the new words; finally, a dictation test is conducted to assess retention. While this structured approach offers consistency, its repetitive and rigid nature often makes students feel fatigued and disinterested, potentially fostering a negative cycle that ultimately discourages their broader engagement with English learning and limits their progress. Additionally, although textbooks are designed with inherent patterns, teachers do not always follow a logical organization of vocabulary teaching and fail to differentiate vocabulary items. This approach unnecessarily increases the cognitive burden on students, making vocabulary acquisition appear disorganized and overwhelming.

In practice, effective vocabulary educators should incorporate appropriate extracurricular extensions to help students acquire additional vocabulary beyond the prescribed curriculum, aligning their instruction with the requirements of the English vocabulary curriculum. While some words merely need recognition, others demand deeper understanding and flexible application. Teachers should go beyond the basic pronunciation and definitions of words to explain their usage, metaphoric meanings, extended connotations, and rhetorical implications. Notably, few educators emphasize using learning strategies, leading students to rely heavily on rote memorization and teacher-centered instruction. Students are rarely encouraged to identify vocabulary learning patterns or explore personalized strategies to suit their exploration. Additionally, assessment methods remain limited and focus primarily on textbook words, limiting students' motivation to engage in extracurricular reading or expand their vocabulary through independent effort. However, many educators face significant challenges due to a lack of professional training in vocabulary teaching strategies, as standardized courses or guidelines for effective vocabulary instruction are still unavailable in most regions. From Chinese teachers' and students' perspectives, English vocabulary learning in rural-urban middle schools presents significant challenges due to its complex semantic variations and lack of clear rules.

To address these issues, the Chinese Curriculum Standards for Compulsory English Education introduced heightened requirements for vocabulary teaching and learning, setting significant emphasis on the role of vocabulary strategies in high-achieving language competencies, such as listening, speaking, reading, and writing, as shown in **Table 1** ^[5]. Notably, the standards highlight vocabulary mastery and usage, requiring students to understand fundamental and contextual meanings of vocabulary, describe behaviors and attributes, and articulate abstract concepts.

Table 1. Chinese Curriculum Standards for Compulsory English Education of Level 2 and Level 5

Level	Grade	Goals
Level 2	Graduation from primary school	1. Learn about 600–700 words and about 50 idioms related to the topic of this level; 2. Understand that words are made up of letters;
Level 5	Graduation from junior high school	1. Understand English vocabulary, including words, phrases, idioms, and fixed collocations; 2. Know and understand the basic meaning of words and their meaning in a specific context; 3. Use vocabulary to describe things, behaviors, and characteristics, and explain concepts; 4. Learn to use 1500–1600 words and 200–300 idioms or fixed combinations

Aligning to these requirements, educators should improve students' vocabulary proficiency and accuracy while expanding their lexicon. In junior high school English teaching, educators should move beyond simply having students recite and memorize words and integrate vocabulary instruction into real communicative practices.

3. Challenges in vocabulary learning for rural-urban fringe junior high school students

Despite its importance, many rural-urban fringe students struggle with vocabulary retention and using it effectively, often leading to errors in word recognition and application. A common issue is the overreliance on rote memorization, which fails to provide students with effective strategies for learning engagement. Consequently, this approach produces suboptimal outcomes and causes students to be disinterested in English learning, and eventually, a portion of the students abandon English learning. Although vocabulary learning is crucial in Chinese junior high school education, several issues hinder progress:

- (1) Overemphasis on knowledge teaching over strategy cultivation: Teachers often prioritize word definitions, pronunciation, and spelling in isolation, neglecting the development of students' learning strategies. Techniques like inferring word meanings from roots and affixes or organizing words based on semantic relationships are rarely incorporated into teaching practices. Additionally, frequent dictation-based assessments fail to develop comprehensive language skills, leaving students with an isolated understanding of vocabulary. Consequently, students rely on mechanical memorization, which often leads to rapid forgetting and poor outcomes despite significant time investment. This inefficiency undermines students' learning enthusiasm and motivation.
- (2) Insufficient contextual integration and cultural awareness: Language serves as a carrier of culture, and cultural differences are imbued with the connotations and associations of words. However, some teachers focus solely on literal meanings, isolating vocabulary explanations from their contextual and cultural dimensions. This approach causes students to have the misconception that English vocabulary is directly equivalent to Chinese, leading to pragmatic errors in word usage. By ignoring cultural nuances and contextual associations, students are deprived of a full understanding of language in its authentic use.

4. Strategies for enhancing English vocabulary acquisition among middle school students in urban-rural fringe areas

4.1. Improving vocabulary memorization skills

Enhancing vocabulary retention through association strategies: Associative strategies, which establish inherent relationships between lexical items, have been shown to effectively facilitate vocabulary retention. By engaging in appropriate associations, students may expand their vocabulary and enhance divergent thinking. In phonetic association, students can recall words by recognizing similarities in pronunciation or spelling. Since many English words appear in similar spellings but convey distinct meanings, targeted instruction in phonetic breakdown can enhance retention. For instance, educators may guide students to review phonetic symbols and break down words into phoneme combinations to facilitate memorization. Examples include the words “someday,” “handle,” “typical,” “incredibly,” “custom,” and “tender.” Furthermore, vocabulary or contextualized sentence audio clips can be played to allow students to repeat and mimic proper pronunciation and improve retention. For instance, sentences such as “That football, being such a simple game to play, is perhaps the basis of its popularity” can enhance vocabulary recall through auditory reinforcement and oral repetition.

Strengthening vocabulary retention through word formation: Effective learning strategies enhance the improvement of vocabulary acquisition with less effort. Vocabulary learning is based on the same principle: once students master systematic memorization strategies and develop proper learning habits, their vocabulary accumulation significantly improves. While secondary school students generally possess foundational vocabulary learning skills, many still take up passive learning approaches, necessitating explicit guidance and reinforcement from educators. To promote autonomous retention through effective vocabulary acquisition strategies, teachers should provide comprehensive instruction on various memory techniques and help students internalize them into ample learning practices. Common word formation strategies which are particularly beneficial in retaining vocabulary include:

Derivation: This strategy involves adding prefixes or suffixes to the root words and modifying word meanings or grammatical functions. For example, prefixes (e.g., “dis-,” “un-,” “in-,” “im-,” “non-,” “mis-,” “ir-”) can convey negation, producing antonyms, such as “agree”/“disagree,” “able”/“unable,” “correct”/“incorrect,” and “possible”/“impossible.” Additionally, suffixes frequently change root words’ part of speech without altering its core meaning, including “-ence” (state/quality), “-(e)r/-or” (agent/person), “-ese” (nationality), “-ess” (female), “-ian” (expert), “-ist” (professional), “-ment” (state), and “-tion” (action/process). The use of common derivation further helps students grasp word meanings by understanding how different affixes modify root words.

Compounding: This strategy combines two or more independent words to form a new word. Compound words are quite prevalent in English, giving rise to compound nouns, adjectives, verbs, and adverbs. Examples are “someday” (n. future occasion), “earthquake” (n. seismic event), “bathroom” (n. washroom), “housework” (n. domestic chores), and “football” (n. sport). Recognizing compound word structures facilitates students in deconstructing and retaining vocabulary more effectively.

Conversion: This strategy refers to the grammatical category transformation of a word without altering its form, endowing it with a new meaning to function across multiple lexical categories depending on context. For example, in the sentence “Don’t trouble trouble before trouble troubles you,” the first and the last “trouble” function as verbs, while the second and third serve as nouns. Recognizing and applying such flexible conversion rules can improve students’ vocabulary comprehension in diverse contexts.

Polysemy: Some words have multiple meanings and function as different parts of speech without requiring any morphological modifications. There are examples, such as seat (n. “a place to sit” / v. “to assign a seat”), smoke (n. “visible vapor” / v. “to inhale tobacco”), and fight (n. “a conflict” / v. “to engage in combat”). Recognizing such polysemy enables students to infer meanings contextually, decreasing the cognitive burden of memorizing isolated definitions.

Abbreviation: This strategy condenses longer phrases into acronyms or initialisms. For instance, the World Trade Organization is commonly abbreviated as WTO. These techniques facilitate understanding of commonly used abbreviations and enhance students’ ability to decode and remember complex terminologies. By guiding students through these word formation strategies, educators can improve students’ overall vocabulary acquisition.

4.2. Expanding vocabulary through extensive reading

Extensive reading is widely recognized as one of the most effective strategies in vocabulary acquisition, particularly in reinforcing previously known vocabulary and ultimately broadening learners’ overall lexical repertoire. Previous studies across psychological, cognitive science, lexicology, semantics, and pragmatics, proposing strategies such as metacognitive, practice-based, focused learning, and lexical chunking approaches, have underscored the importance of reading in vocabulary acquisition ^[6,7].

While there is no universally superior strategy, strategies should be adopted based on individual learners and contexts. In recent years, the role of extracurricular reading and strategies in guiding students’ independent reading has gained scholarly attention. As an extension of classroom instruction, extracurricular reading enriches the learning experience and significantly expands students’ vocabulary.

- (1) Flexibility in reading material selection: While classroom materials are standardized, extracurricular reading materials allow students to explore English based on personal interests, learning objectives, and language proficiency, thereby enhancing greater engagement and retention.
- (2) The role of interest in reading: Psychological studies confirm that Interest-driven reading enhances language learning motivation and engagement. When learners find reading materials engaging, they exhibit greater enthusiasm, enhanced cognitive alertness, and increased concentration. Consequently, this increased involvement facilitates deeper cognitive processing, and highly engaging English reading materials have gained widespread popularity among learners. Studies have consistently shown that interest plays a critical role in facilitating motivation and learning outcomes ^[8].
- (3) Reinforcement of previously learned vocabulary: In addition to acquiring new words, extracurricular reading enables language learners to consolidate previously learned vocabulary. The process of vocabulary acquisition through reading is not solely about learning new vocabulary; additionally, it involves consolidating previously encountered words. High-frequency exposure to vocabulary in different contexts strengthens retention and deepens learners’ understanding of words.

4.3. Recreating language learning environments

Language acquisition strongly depends on the linguistic environment, which applies equally to foreign language learners. Less target language environment exposure often poses significant challenges to language learners. To address this, many universities’ English instructors in China often focus on creating a foreign-language acquisition environment by establishing extracurricular English corners, designing situational dialogues in class, and organizing activities. Engaging reading materials can immerse readers deep into the text, follow the author’s

narrative, and naturally acquire language skills seamlessly.

It has been argued that while participating in various English-speaking activities is beneficial, reading offers distinct advantages. Unlike interactive language-learning activities, which require collaboration, specific time, and location constraints, reading is an individual activity that is free from such limitations. Learners can choose reading materials freely and arrange their reading schedules flexibly. Therefore, educators should actively encourage extracurricular reading and recommend high-quality reading materials to enhance students' academic performance. Although vocabulary previews are common, explicit vocabulary instructions are still necessary within the context of reading and listening exercises. Furthermore, applying newly acquired vocabulary in both oral and written communication is a critical step in reinforcing lexical retention.

4.4. Integrating multiple vocabulary learning strategies

Vocabulary acquisition requires a process of memorization, reinforcement, and application, which involves a proper selection of appropriate memory strategies. Vocabulary learning strategies do not function in isolation; rather, students should adopt a combination of strategies to use vocabulary flexibly and appropriately. During secondary English vocabulary instruction, teachers should emphasize teaching methodologies and foster students' autonomous learning abilities. By the second year of university, students generally possess self-regulation in vocabulary learning, including skills in self-monitoring and self-adjustment. Therefore, vocabulary instruction should balance structured teaching methods with guidance that actively engages students, fostering their intrinsic motivation to learn vocabulary. Integrating metacognitive, social, and cognitive strategies can facilitate vocabulary learning.

5. Recommendations for strategy training

5.1. Tailoring appropriate vocabulary strategy training models based on student needs

Wen proposed three specific vocabulary training methods ^[3]. The first method is intensive training, which refers to dedicated time to training learning strategies. She argues that targeted and deliberate strategy training can be conducted in one or multiple sessions. The second method is integrated training, where strategy can be incorporated into regular instruction, aiming to develop students' self-assessment ability. The third is individualized guidance, which aims to identify and assist students who experience significant learning difficulties and require specific, tailored support. Similarly, Cohen categorizes strategy training into four types: Cognitive strategies involve general learning strategies training and language skills development; Metacognitive strategies involve learners being trained to control their cognition in the process of planning and evaluating by themselves ^[9]. Affective strategies refer to awareness training that aims to raise students' consciousness of learning strategies; Social strategies involve learners interacting with other learners or native speakers.

Rural-urban fringe middle school students often rely on rote memorization and have limited awareness of effective vocabulary learning strategies. At the initial stage, teachers may introduce students to metacognitive, cognitive, and social/affective strategies during intensive training. After training in planning strategies, cooperative strategies, inferencing strategies, dictionary strategies, and extensive reading strategies, students can have a comprehensive understanding of vocabulary learning.

- (1) Diversified assessment of strategy training: Teachers should not rely solely on English-to-Chinese translation or word dictation as assessment tools, as these methods fail to show the full scope of students' vocabulary learning. Vocabulary acquisition extends beyond translation; it also involves collocation and lexical associations. Additionally, the achievements of strategy training should not only

be assessed in knowledge acquisition but also encompass skill development and change in learning habits and attitudes.

- (2) Arousing students' vocabulary learning motivation: Research indicates there is a strong correlation between students' vocabulary learning motivations and their strategy use. Students with a higher level of vocabulary learning awareness tend to employ more advanced strategies and vice versa. Students tend to adopt learning strategies that align with their perceptions of vocabulary acquisition. To ensure the effectiveness of strategy training, teachers should guide students in integrating contextualized vocabulary learning and practical application. By fostering effective learning habits, students are expected to seek personalized learning approaches and vocabulary learning strategies to enhance learning efficiency.

5.2. Vocabulary learning strategies training in class

Chamot and O'Malley proposed a four-stage instructional model for strategy training: Planning, Monitoring, Problem Solving, and Evaluation ^[4]. As the following shows, to illustrate how this model is to be applied in vocabulary learning strategy training, Unit 1 of the junior high school English textbook is taken as an example.

- (1) Planning: In the first stage, the teacher selects the target phrase "in order to" from the text; students are asked to preview the passage, learn its meaning and synonymous phrases, and note differences. This task is self-directed, allowing students to choose their preferred learning methods. Some students may use bilingual dictionaries, others may infer meaning from context, and some may prefer to find definitions in the textbook.
- (2) Monitoring: Teachers can assist students by presenting the learning material and explaining the new vocabulary in context to reduce student anxiety. Then, students can analyze the text independently based on prior knowledge. For instance, students may recall that they knew the superficial meaning of "in order to" from their junior high school studies, and the teacher encourages students to compare it with the deeper understanding gained from the current insights. Group discussions further enhance comprehensive understanding, and students may be encouraged to explore synonyms and subtle differences in contextual applications.
- (3) Challenges solving: During this stage, students may encounter challenges, such as distinguishing "in order to" from "so as to." Using Schmitt's communication strategy, students may ask the educator questions ^[10].

"He got up very early in order to/so as to catch the first bus."

"In order to catch the first bus, he got up very early."

Through comparisons, students find that while these two expressions share the meaning "for the purpose of," "so as to" is incorrect to be put at the beginning of a sentence. Teachers can encourage students to recognize this kind of set phrase independently to reinforce analytical skills.

- (4) Assessment: Once students have completed the vocabulary learning tasks, the teacher can conduct a comprehensive review of "in order to" to ensure their comprehension. Students then assess their strategy learning and use these strategies for future vocabulary learning.

5.3. Reinforcing the effectiveness of vocabulary learning strategies

As English education in China undergoes continuous reform, the limitations of traditional vocabulary learning in junior high school become increasingly apparent. There is a growing need for efficient vocabulary learning

strategies to enhance students' lexical competence. To achieve this, teachers must deeply study the nature of vocabulary acquisition and the cognitive and psychological characteristics of junior high school students. By doing so, educators can implement innovative instruction with effective vocabulary strategies to foster students' active exploration, self-motivated learning, and strategic vocabulary use.

Teachers should focus on student-centered instruction, promoting active participation in vocabulary learning activities to deepen comprehension and retention. Additionally, providing diverse learning resources can enrich students' vocabulary and improve their vocabulary usage ability. Students will develop greater autonomy and creativity in language learning by integrating vocabulary learning strategies, ultimately building a solid foundation for their English proficiency.

6. Conclusion

By emphasizing the limitations of traditional rote memorization, this study highlights the vocabulary acquisition challenges faced by rural-urban fringe junior high school students in China. It advocates a student-centered and strategy-based approach, integrating cognitive, metacognitive, and social strategies to enhance vocabulary retention and application.

The findings suggest that the four-stage instructional model by Chamot and O'Malley provides a structured framework for implementing these strategies, fostering students' autonomy and motivation^[4]. Integrating extensive reading and interest-driven learning is particularly effective in reinforcing vocabulary acquisition, while diversified assessment methods ensure a comprehensive evaluation of students' improvement. To address the educational gap between urban and rural areas, by adopting vocabulary instruction strategies and these innovative approaches, educators can improve students' English proficiency for academic achievement and real-world communication, and foster greater equity in language education. Dynamic, strategy-driven vocabulary learning approaches strengthen students' lexical proficiency and empower them to engage in English learning more effectively, preparing them for success in an increasingly globalized world.

Disclosure statement

The author declares no conflict of interest.

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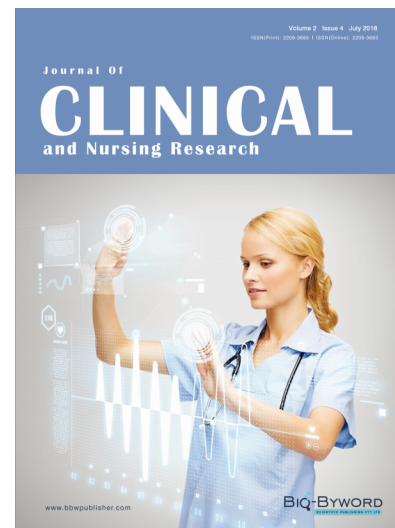
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