

(4) Simplified procedure: Students' drawing assignments are posted in the discussion area in the form of pictures, and there is no need to hand in paper or electronic versions of the assignments;

(5) Emphasize the originality of drawing assignments. It is allowed to simulate drawing, but it is not allowed to copy and paste others' drawings directly;

(6) Confirm that the drawing method is the final assessment method for the usual performance, so as to correct students' learning attitude^[11].

The example is as follows:

(1) Explain the composition of the elbow joint arterial network and emphasize its importance;

(2) Teacher's demonstration: first draw the humerus, ulna and radius that constitute the elbow joint (the 3 bones are in the same color), then draw the 3 main arterial trunks running in the arm and elbow: brachial artery, ulnar artery and radial artery (in red), draw the branches of the 3 main arterial trunks (still in red), and finally connect the branches in series (each arterial pathway is in one color, and not all in the same color);

(3) Assign homework in the discussion area: elbow joint arterial network;

(4) Students post their drawings in the discussion area.

2.5. Assessment methods

2.5.1. Performance evaluation

Both the experimental group and the control group of students will be assessed through the following methods: unified standards for practical specimen assessment with random physical object evaluation; unified standards for marking the final theoretical examination; phase tests, etc. The composition ratio of the final evaluation results is shown in **Table 1**.

4.肘关节动脉网

- 也称肘关节网。
- 由肱动脉、桡动脉和尺动脉的9条分支相互吻合而成。
- 主要吻合有4处：
 - 尺侧下副动脉与尺侧运动脉的吻合；
 - 尺侧上副动脉与尺侧下副动脉、尺侧运动脉的吻合；
 - 桡侧副动脉与桡侧运动脉的吻合；
 - 中副动脉与骨间运动脉的吻合。

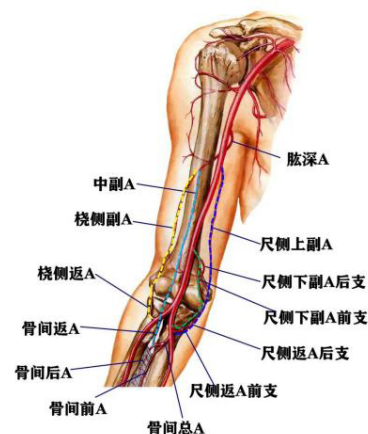


Figure 1. Composition of the elbow joint arterial network.

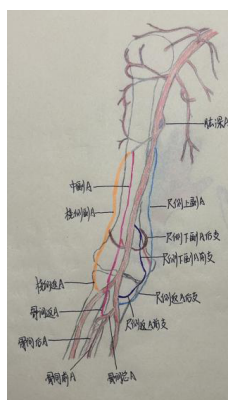


Figure 2. Students' electronic drawing.

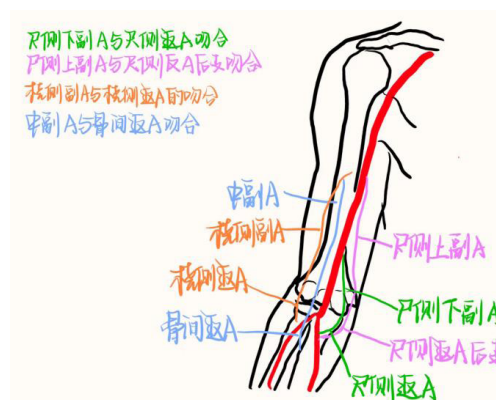


Figure 3. Students' colored pencil drawing.

Table 1. Composition ratio of final evaluation results

Course performance composition		Assessment score composition		Assessment methods
Item	Proportion	Item	Proportion	
Process assessment score (usual performance)	40%	Online comprehensive score (comprehensively formed by online autonomous learning completion, in-class quizzes, chapter self-tests and interactive data flow)	20%	Online exam (automatically generated by network platform data)
		Practical specimen assessment	10%	On-site real-time assessment and scoring
		Phase tests (2 times)	5%	Online exam (automatically scored upon online completion)
		Offline classroom evaluation	5%	Assessment and scoring among TBL classroom learning groups
		Subtotal	40%	
Final exam score	60%	Final exam	60%	Closed-book on-site computer-based exam
Total	100		100%	

2.5.2. Questionnaire survey

Questionnaires will be distributed, and the evaluation content includes: understanding and memorizing knowledge, systematically mastering knowledge, enhancing learning interest, improving comprehensive analysis ability, and the close connection between basic knowledge and clinical practice. The evaluation results include: agree, disagree.

2.6. Statistical processing

The results of this study will be analyzed using SPSS 22.0. Measurement data will be expressed as mean \pm standard deviation (SD) and tested by *t*-test; count data will be expressed as percentages and tested by χ^2 test; $P < 0.05$ indicates that the difference is statistically significant.

3. Results

3.1. Assessment of practical specimens

The experimental group had a significantly better understanding of specimens than the control group, and the scores of the experimental group were significantly higher than those of the control group. The difference between the two groups was statistically significant ($P < 0.05$), as shown in **Table 2**.

3.2. Final theoretical examination

The scores of the experimental group were significantly higher than those of the control group. The difference between the two groups was statistically significant ($P < 0.05$), as shown in **Table 2**.

Table 2. Comparison of scores in practical specimen assessment and final theoretical examination between the control group and the experimental group (mean \pm SD, points)

Group	n	Practical specimen assessment	Final theoretical examination
Control group	27	95.74 \pm 1.78	63.07 \pm 12.74
Experimental group	28	99.29 \pm 9.27	69.92 \pm 9.39

3.3. Results and analysis of the questionnaire survey

The results of the questionnaire survey on learning effects between the control group and the experimental group showed that students who participated in the review after the drawing assignment class were better in understanding and memorizing knowledge, enhancing learning interest, improving comprehensive analysis ability, and establishing a close connection between basic knowledge and clinical practice (**Table 3**).

Table 3. Comparison of the learning effects questionnaire survey between the control group and the experimental group

Survey content	Control group		Experimental group	
	Agree	Disagree	Agree	Disagree
Understanding and memorizing knowledge	25	2	27	1
Mastering knowledge systematically	25	2	27	1
Enhancing learning interest	24	3	24	4
Improving comprehensive analysis ability	25	2	27	1
Close connection between basic knowledge and clinical practice	24	3	28	0

4. Discussion

Under the new normal, the development of the environment and technology has given birth to teaching models that are more in line with the needs of learners^[12]. The after-class review session, as one of the key steps that widens the gap in students' learning efficiency, is easily overlooked in higher education. The fundamental reason is that college students have transitioned from a high school education with low freedom to a higher education with broad freedom. Educational researchers often focus on pre-class preparation and in-class teaching, neglecting the significant role of after-class review in higher education teaching. This paper researches after-class drawing assignments for clinical medicine majors with the help of the Xuexitong platform, hoping to arouse the attention of educational researchers to students' after-class review. Different disciplines have different ways of after-class review, but the impact of the after-class review model on students' learning and teachers' teaching is always positive feedback. Under the modern teaching model, the fine traditions in traditional teaching should continue to play a role. The drawing method has always been a highlight in anatomy teaching. Professor Huo Kun from China Medical University, who is regarded as a "soul painter" by a large number of medical students on Bilibili, teacher Zhang Bo from Zhejiang Chinese Medical University who has been reported by many media, and the team of Professor Sui Hongjin, together with anatomy teachers from Dalian Medical University, Guangdong Medical University, Air Force Medical University and Peking University, have collected, sorted out and revised the blackboard drawings often used in teaching over the years, and developed several new blackboard drawings based on the key and difficult points in the teaching syllabus and teaching, which are

compiled into the book *Learning Anatomy through Drawing for Beginners* ^[13]. Behind these cases, there is an outstanding advantage of the drawing method in the process of anatomy learning: anatomy drawing enables students to memorize knowledge points efficiently. In the same period of time, compared with words, drawing can closely connect more scattered anatomy knowledge points and deepen students' memory. The author of this paper introduces drawing into anatomy teaching in the form of after-class assignments, which, to a certain extent, realizes the visualization and explicitness of classroom knowledge, and is more conducive to students' mastery of the layers, adjacencies, and clinical integration of topographic anatomy ^[14,15].

5. Conclusion

In conclusion, with the widespread application of the blended teaching model, using the “Discussion” section of the Xuexitong APP to consolidate students' learning of the Topographic Anatomy course after class in the form of drawing assignments is a reference method for after-class review in the teaching of medical morphology courses. The sample size of this study is small and the evaluation system is not perfect. Limited by these factors, its effectiveness still needs further research and exploration by the author.

Funding

Guangxi First-Class Undergraduate Course: Funded Project of Regional Anatomy (Project No.: 02502220148C)

Disclosure statement

The authors declare no conflict of interest.

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Problems and Countermeasures of College Students' Mental Health in Higher Education in the New Era

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Abstract: Against the backdrop of the new era, mental health issues among college students in the higher education stage have become increasingly prominent. These issues are not only related to the personal growth of students but also affect the quality of national talent cultivation and the harmonious development of society. Therefore, this study focuses on the current mental health problems of students in the higher education environment. A systematic analysis method was adopted to examine various factors contributing to this phenomenon from multiple perspectives, such as academic pressure, interpersonal relationships, and self-cognition. To address this problem, a series of practical strategies was proposed, aiming to provide guidance for colleges and universities, help students establish a positive mental state, and enhance their coping abilities. It is expected that these efforts will effectively improve students' mental health, promote their all-round and healthy growth and development, and at the same time contribute to building a harmonious society.

Keywords: Higher education; Mental health; Collaborative education; Educational countermeasures

Online publication: October 17, 2025

1. Mental health issues among students in higher education

1.1. Intertwined academic and employment pressure

As the wave of higher education popularization continues to advance and the phenomenon of “involution” (excessive internal competition) intensifies, students are facing unprecedented academic challenges. Courses have become more profound and complex, competition in scientific research has grown fiercer, while the demand in the job market shows a tightening trend. The combination of these factors imposes heavy psychological pressure and mental burden on students. They often feel confused and helpless, filled with uncertainty about the future. Such emotional fluctuations can easily evolve into mental health problems such as anxiety and depression. In particular, some students with relatively weak willpower may fall into the predicament of insufficient learning motivation, unable to maintain a proper learning state, and even experience a crisis of self-identity^[1]. This not only affects their personal development but also exerts an adverse impact on the improvement of the overall

quality of society. Therefore, the study must take effective measures to alleviate students' academic pressure, provide necessary psychological support, and help them maintain a positive and optimistic attitude to better cope with the various challenges encountered in higher education ^[2].

1.2. Dilemmas in emotions and interpersonal relationships

The behavior of over-reliance on social media is gradually eroding people's ability to communicate with others in real life. In this digital age, students are addicted to virtual social circles, often neglecting the importance of interpersonal relationships and the necessity of in-depth communication in real life. Minor frictions in dormitories, misunderstandings between lovers, and even emotional estrangement among family members—issues that should be properly addressed in daily life—have become complicated and intractable due to the lack of direct face-to-face communication. As a result, many students feel lonely; their inner world is gradually occupied by indifference and misunderstanding, and the foundation of interpersonal trust is thus shaken. In the long run, some people may even fall into psychological predicaments, exhibiting extreme emotional reactions or behavioral patterns—all of which are highly risky signs for mental health ^[3–5].

1.3. Conflicts in values and adjustment disorders

In this era of multicultural integration, society is undergoing a profound reshaping of values. Amid this context, students are confronted with an irreconcilable gap between ideals and reality, as well as conflicts and integration between individual and collective values. The interplay of these factors makes students particularly confused in their journey of self-cognition. Some students may experience a deep sense of existential anxiety, which stems from the uncertainty about future goals and the challenges encountered in seeking personal positioning and value recognition in a rapidly changing environment. They may feel that their lives lack a certain direction and have profound doubts about the meaning and purpose of life, thus falling into deep contemplation and struggle ^[6].

1.4. Imperfect mental health service system

In the current higher education system, a prominent and widespread problem is the shortage of mental health counseling resources. This situation is reflected not only in the insufficient number of counselors but also in their lack of necessary professional knowledge and skills. Furthermore, the intervention mechanisms for students' psychological problems in colleges and universities are often slow to respond and fail to keep pace with the development of the times, resulting in delayed prevention work ^[7]. At the same time, the awareness of protecting personal privacy is relatively weak, which to a large extent restricts students' willingness to seek help. The combined effect of these factors makes it difficult for students to detect abnormalities in their mental state at an early stage. When problems do emerge, the effectiveness of intervention is naturally greatly reduced ^[8].

2. Countermeasures and suggestions for students' mental health education in the higher education process

2.1. Construct a full-process mental health education system

In the current education system, the study has recognized the importance of mental health education. Therefore, the study has decided to incorporate it into students' compulsory courses to provide them with comprehensive support and guidance. These courses will cover multiple key areas, such as how freshmen adapt to college life, cope with academic pressure, and manage emotions. By introducing case-based teaching and practical experience, the study aim to help students better understand the connection between theoretical knowledge and practical application,

thereby improving learning outcomes and the effectiveness of the courses. This initiative not only helps students build positive psychological resilience but also lays a solid foundation for their personal development in the future.

In today's digital era, the study is well aware of the significance of new media platforms in popularizing mental health knowledge. Thus, the study is committed to conducting regular mental health science education through these platforms. For example, the study has created a series of "mental health micro-class" short videos, which explain psychological knowledge in a relaxed and easy-to-understand way, helping students understand and cope with psychological challenges they may encounter in daily life. Meanwhile, the study has also launched an online "tree hole" talk space, encouraging students to voice their thoughts here. Whether it is about academic pressure, interpersonal relationships, or emotional distress, they can receive listening and guidance from professionals^[9-12]. Through such efforts, the study hopes to create a campus culture where all members pay attention to mental health, allowing everyone to find support and comfort in this open and inclusive environment.

2.2. Improve the "Prevention-Intervention-Rehabilitation" tertiary support network

To better serve students' mental health, the study will establish a comprehensive and dynamic psychological assessment mechanism. By conducting an initial psychological assessment upon students' enrollment and conducting follow-up evaluations throughout their study period, the study can identify groups that may be in a high psychological risk state. For these individuals, the study will adopt a precise support strategy of "one person, one policy" to tailor personalized assistance plans for them.

Strengthening collaboration among various departments within the university is crucial. The study will enhance the linkage mechanism among school doctors, counselors, and head teachers. Through this mechanism, the referral channel for psychological counseling will become smoother. In addition, the study also plans to cooperate with some professional medical institutions to establish a green channel for emergency intervention, ensuring that professional medical support can be obtained quickly in emergencies. Such measures will greatly improve the university's ability and efficiency in addressing students' psychological issues and protect every student's mental health from threats.

2.3. Optimization of stress management and value guidance mechanisms

To promote the all-round development of students, the study has actively implemented the academic mentor system. This system not only provides students with academic guidance but also pays attention to their career planning. Through well-designed workshops, the study aims to help students better understand their interests and strengths, enabling them to stand out in the fiercely competitive job market. Furthermore, these workshops focus on cultivating students' psychological resilience when facing challenges, allowing them to stay calm and find solutions when encountering difficulties. With such comprehensive support, the study hopes to stimulate students' potential and guide them to become future professionals who are forward-looking, adaptable, and confident^[13].

In the current era, ideological and political education is not merely the inculcation of theoretical knowledge from textbooks; it requires students to gain a profound understanding and grasp of relevant concepts through social practice activities. Through these diverse carriers, the study can guide students to establish a dialectical outlook on values—when recognizing the complexity and multidimensionality of the world, they can uphold their principles, pursue truth, and courageously take on social responsibilities. Meanwhile, this educational approach can foster students' self-efficacy: they will learn to believe in their own abilities, actively participate in social activities, continuously improve their quality in the process of serving society, enhance their ability to solve practical problems, and ultimately maximize their personal value. Such an educational model not only helps students form

correct worldviews, outlooks on life, and values but also lays a solid foundation for them to become useful members of society in the future.

2.4. Strengthening the teaching staff and hardware support

To ensure that the mental health of teachers and students receives adequate attention and support, schools should assign a full-time psychological counseling teacher to each student based on actual circumstances. These professionals should not only receive regular training on crisis intervention skills to improve their ability to handle emergency psychological issues, but also a sound psychological care mechanism for teachers should be established. The key to this mechanism lies in providing teachers with the necessary emotional support and professional incentives to prevent occupational burnout. In this way, the study can effectively prevent negative emotional reactions of teachers when interacting with students, thereby ensuring the smooth progress of counseling work and truly addressing both the growth needs of students and the psychological status of teachers themselves^[14].

To improve the public's mental health, the study has decided to further strengthen the development of mental health centers. To this end, the study will not only optimize the facilities and equipment in psychological counseling rooms but also expand the functions of group counseling rooms, creating a supportive environment where people can communicate and learn from each other. At the same time, the study plan is to introduce advanced technologies to enhance service quality. For example, the use of artificial intelligence (AI) for psychological assessment will enable us to quickly and accurately diagnose an individual's psychological state, while virtual reality (VR) relaxation training can help clients experience relaxation and stress relief in a safe environment. The application of these new technologies is expected to greatly improve the accuracy and effectiveness of services, providing more personalized and high-quality support for those in need^[15].

3. Conclusion

Against the backdrop of rapid social transformation, the mental health issues faced by college students in higher education have become increasingly prominent. This is not only a matter of individuals' psychological quality but also a concentrated reflection of various contradictions in society, education, and other fields. The severity of this problem requires us to fundamentally innovate educational concepts, promote institutional innovation, and integrate resources to build a comprehensive and multi-level new pattern of "school-family-society" collaborative education. Such a framework will provide a solid psychological safety barrier for students' growth and development, allowing them to thrive in an environment full of support and understanding.

In this process, higher education institutions need to deepen their understanding of students' all-round development—focusing not only on the cultivation of academic abilities but also on the development of non-intellectual factors such as students' emotions, willpower, and social skills. Therefore, education authorities should take effective measures, such as establishing specialized mental health counseling services, offering mental health education courses, and building psychological crisis intervention mechanisms, to address students' psychological stress and challenges. Meanwhile, family education should also play its important role: through parent schools, parent workshops, and other forms, parents are guided to pay attention to their children's mental health and work together to create a family atmosphere conducive to the physical and mental health of children. In addition, all sectors of society should actively participate in this work, providing necessary resource support and policy assistance to jointly build a healthy and positive social environment. Only when these elements cooperate and interact with each other can higher education truly achieve the connotative development

transformation from simply “cultivating talents” to “educating people”, allowing every student to find their own value and achieve a bright future in this process.

Disclosure statement

The author declares no conflict of interest.

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Application of Micro-lecture Combined with Flipped Classroom in Clinical Nursing Teaching for Operating Room Nursing Students

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Abstract: This study explores the implementation effects of a teaching model combining micro-lectures and flipped classrooms in clinical nursing education within operating rooms of Grade A tertiary hospitals in Hainan Province, aiming to provide scientific references for optimizing nursing training systems. Methods: A total of 72 nursing interns in the operating room of a Grade A tertiary hospital in Hainan Province from July 2021 to June 2022 were selected and divided into a control group (traditional teaching) and an observation group (micro-lectures combined with flipped classrooms) based on their admission time, with 36 students in each group. The control group followed the traditional model of centralized lectures, operational demonstrations, and group practice. In contrast, the observation group implemented diversified teaching activities via the DingTalk platform, including micro-lecture video releases, group case discussions, real-scenario simulations, and online quizzes. The effects of the two groups were evaluated through theoretical assessments, practical performance scores, teacher-student mutual satisfaction surveys, and teaching effectiveness questionnaires. Results: The observation group significantly outperformed the control group in both theoretical scores (29.5 ± 0.7 vs. 27.6 ± 1.8) and practical scores (68.9 ± 1.1 vs. 63.2 ± 2.4), with statistically significant differences ($P < 0.01$). Teacher-student satisfaction in the observation group (77.8% for teachers, 83.3% for students) was notably higher than that in the control group (47.2% for teachers, 52.8% for students) ($P < 0.01$). The recognition rate of the teaching model in the observation group exceeded 85%. Conclusion: The integration of micro-lectures and flipped classrooms effectively enhances nursing students' theoretical and practical abilities, aligns with Hainan Province's "Smart Healthcare" development needs, and demonstrates promotional value.

Keywords: Operating room; Clinical nursing education; Micro-lectures; Flipped classroom; Nursing internship; Hainan Province

Online publication: October 17, 2025

1. Introduction

With the rapid development of medical technology and the deepening of reforms in nursing education, the

traditional “teacher-centered” teaching model can no longer meet the needs of modern nursing talent training ^[1]. Operating room nursing is a discipline with extremely strong clinical practicality, requiring nursing students to not only have a solid theoretical foundation but also master standardized operational skills. However, there are many problems in traditional teaching, such as limited class hours, disconnection between theory and practice, and insufficient initiative of students, which restrict the improvement of nursing students’ comprehensive abilities.

In recent years, the combined application of micro-lectures and flipped classrooms has provided new ideas for nursing education ^[2]. Micro-lectures focus on core knowledge points through short videos, making it convenient for students to learn anytime and anywhere; flipped classrooms place the knowledge transmission link in advance, and class time is used for in-depth interaction and practical reinforcement, thereby improving learning efficiency. As a medical tourism demonstration zone, Hainan Province has put forward higher requirements for the comprehensive abilities of operating room nursing talents, including but not limited to healthy physical fitness, good psychological quality, coordination ability and dedication, a high sense of sterility, a relatively complete knowledge structure, and excellent technical skills. Based on the current situation of nursing teaching in Hainan Province, this study explores the application effect of micro-lectures combined with flipped classrooms in the teaching of operating room nursing students, aiming to provide references for regional nursing education reform.

2. Materials and methods

2.1. Research objects

A total of 72 nursing interns in the operating room of a tertiary-level hospital in Hainan Province from July 2021 to June 2022 were selected and divided into a control group (July–December 2021) and an observation group (January–June 2022) according to the time of entering the department, with 36 interns in each group.

Control group: 30 females and 6 males; aged 20–24 years old; 18 undergraduates and 18 junior-college students.

Observation group: 31 females and 5 males; aged 20–23 years old; 17 undergraduates and 19 junior-college students.

The two groups were well-balanced in baseline data such as gender, age, and educational background, with no significant statistical difference ($P > 0.05$), and were comparable.

2.2. Teaching methods

Both groups carried out a 4-week clinical internship, and the teaching content and assessment standards were the same.

The control group adopted the traditional teaching model, which included centralized theoretical teaching, practical operation demonstration, group-based practical training, and immediate on-site guidance by teachers.

The observation group implemented the teaching of micro-lessons combined with a flipped classroom. The specific process was as follows:

- (1) Pre-class preparation: Micro-lesson videos (covering aseptic technique, instrument transfer, infection control, etc.) were released through the DingTalk group, and preview tasks were assigned, requiring nursing interns to complete online previews and submit questions.
- (2) Classroom interaction: students discussed typical cases in groups, such as the response strategy for

sudden massive hemorrhage during operation. Teachers guided in a timely manner to promote students to analyze problems and conceive solutions.

- (3) Practice reinforcement: through the real-scene operation videos in the operating room, nursing interns watched and learned multiple times, and then practiced with simulated instruments. Teachers immediately commented on the standardization of operations.
- (4) Post-class consolidation: knowledge points were consolidated through online quizzes (multiple-choice questions, case-analysis questions) and writing case reports. Teachers graded regularly and answered questions.

2.3. Evaluation indicators

- (1) Assessment score: Theoretical examination (30%) + Practical operation assessment (70%), with a total score of 100 points.
- (2) Mutual evaluation of satisfaction: the Likert 5-level scale (very satisfied, satisfied, general, dissatisfied, very dissatisfied) was used to evaluate the satisfaction of teachers and students.
- (3) Teaching effect questionnaire: the observation group filled in the questionnaire on the recognition of the teaching model, covering dimensions such as teaching methods, time arrangement, and resource application.

2.4. Statistical methods

SPSS 26.0 was used for data analysis. Measurement data were expressed as mean \pm standard deviation (SD), and an independent-sample t-test was used for comparison between groups; count data were expressed as rate (%), and chi-square test was used. $P < 0.05$ was considered as having a significant statistical difference.

3. Results

3.1. Assessment scores

The total score of the observation group (98.2 ± 1.5) was significantly higher than that of the control group (91.3 ± 2.6) ($t = 13.241$, $P < 0.01$). The comparison of assessment scores of nursing interns in the two groups is shown in **Table 1**.

Table 1. Comparison of assessment scores of nursing interns in the two groups (Points, mean \pm SD)

Group	Number of people	Practical score	Theoretical score	Total score
Control group	36	63.6 ± 1.2	27.7 ± 1.4	91.3 ± 2.6
Observation group	36	69.1 ± 0.7	29.1 ± 0.8	98.2 ± 1.5
<i>t</i>		7.416	9.561	13.241
<i>P</i>		< 0.01	< 0.01	< 0.01

3.2. Mutual evaluation of satisfaction

The teacher satisfaction (77.8% vs 47.2%) and student satisfaction (83.3% vs 52.8%) in the observation group were significantly better than those in the control group ($P < 0.01$) (**Table 2**).

Table 2. Comparison of satisfaction results of mutual evaluation between teachers and students in the two groups (Pearson, %)

Group	Number of People	Nursing Student Evaluation			Teacher Evaluation		
		Satisfied	Basically Satisfied	Dissatisfied	Satisfied	Basically Satisfied	Dissatisfied
Control Group	36	18 (50.00)	10 (27.78)	8 (22.22)	16 (44.44)	13 (36.11)	7 (19.45)
Observation Group	36	28 (77.78)	7 (19.44)	1 (2.78)	26 (72.22)	8 (22.22)	2 (5.56)

3.3. Evaluation of teaching effectiveness

83.33% to 94.44% of nursing students in the observation group recognized this model in terms of the rationality of teaching methods (94.44%), time arrangement (88.89%), teaching approaches (91.67%), and teaching effectiveness (83.33%). Among them, two newly added measures, application of micro-lecture resources (91.67%) and after-class self-study (83.33%), also gained high recognition. All dimensions of this training model achieved excellent acceptance.

4. Discussion

4.1. Advantages of the teaching model

The “online + offline” blended learning model, combining micro-courses and flipped classrooms, has significantly improved teaching efficiency and quality through the deep integration of digital tools with traditional classrooms. In the online phase, nursing students can repeatedly watch micro-course videos on the DingTalk platform, covering core content such as “Aseptic Technique Operation Specifications” and “Surgical Instrument Transfer Procedures.” This fragmented learning approach not only breaks through the time and space constraints of traditional teaching but also allows students to flexibly arrange study plans according to their individual progress. For example, nursing students in this study watched micro-courses 3–4 times weekly, each session lasting 20–30 minutes, with post-class online quiz accuracy rates exceeding 85%, demonstrating the significant effect of micro-courses in reinforcing theoretical knowledge.

Class time has shifted from the traditional one-way inculcation of knowledge to interactive learning. Teachers guide students to propose solutions by discussing typical cases (e.g., “Emergency Management of Intraoperative Massive Hemorrhage”) in groups, combining theoretical knowledge. This “Problem-Based Learning (PBL)” model not only cultivates students’ clinical thinking skills but also enhances practical abilities through role-playing and simulation operations. For instance, in simulated operating room scenarios, students must complete tasks like instrument inventory and aseptic area maintenance, with instructors providing immediate corrections on operational details. Results showed that the aseptic technique qualification rate in the observation group increased from 78% in traditional teaching to 92%, with significantly improved operational standardization. This finding aligns with the core concept of flipped classrooms proposed by Bergmann et al. (2012), which emphasizes focusing classroom time on deep learning and practical application through pre-delivered knowledge transfer ^[3,4]. Additionally, Li et al. (2019) noted that video-based micro-course instruction effectively improves students’ understanding of complex procedures ^[5].

Furthermore, simulated teaching of real surgical scenarios further enhances students’ on-site adaptability. By recording actual surgical operation videos (e.g., laparoscopic surgery coordination), students can visually observe the collaboration between surgeons and nurses and master key steps through repeated viewing. This method complies with the “Standardized Nursing Training” requirements of the Hainan Provincial Health Commission,

particularly suitable for high-risk clinical environments like operating rooms. Research by Chen et al. (2021) also indicated that flipped classrooms effectively shorten the transition period from theoretical learning to clinical application by strengthening practical components ^[6].

4.2. Implications for nursing education in Hainan Province

As a national medical tourism demonstration zone and free trade port, Hainan Province imposes higher requirements on the comprehensive quality of nursing talents. The digital features of micro-courses and flipped classrooms (e.g., DingTalk platform, real-scenario videos) closely align with Hainan's "Smart Healthcare" strategy ^[7–10]. Through online platforms, nursing students in remote areas (e.g., grassroots hospitals in Sanya and Qionghai) can access high-quality teaching resources from Class III Grade A hospitals, reducing educational disparities caused by geographical differences. For example, in this study, the micro-course content was simultaneously pushed to 12 cooperative hospitals across the province through DingTalk groups, covering more than 200 nursing students, and the teaching satisfaction rate reached over 80%.

The development of localized teaching resources is another highlight. Hainan's unique tropical diseases (e.g., dengue fever, malaria) pose special requirements for operating room nursing. The research team designed a thematic micro-course on "Infection Control for Tropical Disease Surgeries" based on local case characteristics and invited infectious disease experts to participate in case discussions. Results showed that the observation group's assessment scores for this topic increased by an average of 15%, indicating that targeted teaching significantly enhances clinical adaptability. Research by Hu et al. (2022) also emphasized that regionalized teaching resources are crucial for improving the practicality of nursing education.

Moreover, this model provides new insights for the long-term development of nursing education in Hainan. For example, integrating Virtual Reality (VR) technology can simulate complex surgical scenarios (e.g., heart transplantation, craniocerebral trauma surgery), helping students accumulate experience in risk-free environments. The Hainan Provincial Department of Education explicitly stated in the Higher Vocational Education Development Plan (2021–2025) the need to "promote the deep integration of information technology with nursing education," and this study offers a feasible path toward achieving this goal.

4.3. Limitations and improvement directions

Despite the study's positive outcomes, several limitations remain:

- (1) Outdated micro-course resources: Some students reported that certain video content did not reflect the latest clinical guidelines (e.g., the 2022 revised Operating Room Infection Prevention and Control Specifications). In the future, a dynamic resource library should be established, with an update team comprising clinical physicians, nursing experts, and educational technology teams to review and optimize teaching content quarterly.
- (2) Inadequate technology integration: Current teaching relies primarily on 2D videos, lacking immersive experiences. Introducing VR technology could address this gap. For example, Wu et al. (2022) used VR to simulate laparoscopic surgery, improving students' operational proficiency by over 30% ^[11–14].
- (3) Underdeveloped cross-regional cooperation mechanisms: Resource sharing is currently limited to some provincial hospitals. Future efforts should explore collaborations with medical colleges in neighboring provinces like Guangdong and Guangxi to establish regional teaching alliances and share micro-course resources and training equipment. The "Cloud Platform for Micro-Course Resource Libraries" proposed by Wang et al. (2022) provides a technical foundation for this ^[15].

4.4. Insights for national nursing education

The findings of this study are not only applicable to Hainan but also offer references for nursing education reforms in other regions. For instance, in western regions, micro-course platforms could alleviate teacher shortages; in developed areas, personalized learning systems could be developed by integrating Artificial Intelligence (AI) technology. Research by Liu et al. (2018) demonstrated that big data-driven intelligent teaching systems can accurately identify students' learning weaknesses and deliver customized content.

5. Conclusion

The combination of micro-lectures and a flipped classroom, through the closed-loop design of “knowledge pre-positioning-in-depth interaction-practice enhancement”, has significantly improved the theoretical level and operational ability of operating room nursing students. The research shows that the theoretical scores (29.5 ± 0.7 vs 27.6 ± 1.8) and operational scores (68.9 ± 1.1 vs 63.2 ± 2.4) of the observation group are significantly better than those of the control group ($P < 0.01$), and the satisfaction of teachers and students reaches 77.8% and 83.3% respectively. This model not only meets the development needs of “smart medical care” and “standardized nursing training” in Hainan Province, but also provides the following promotion strategies for national nursing education:

- (1) Dynamic resource construction: Establish a micro-lecture update mechanism, incorporating the latest clinical guidelines and technologies.
- (2) In-depth integration of technology: Introduce tools such as VR and AI to create an immersive and personalized learning environment.
- (3) Regional collaborative innovation: Expand the coverage of high-quality resources through cross-provincial cooperation and promote educational equity.

Future research can further explore the teaching model of multi-technical linkage (such as “micro-lecture + VR + AI”) and evaluate its long-term effects, so as to continuously promote the digital transformation of nursing education.

Funding

Research on the Application of “Micro-lecture + Flipped Classroom” Teaching Resources and Modes in Clinical Teaching for Operating Room Nursing Students (Project No.: 2022BC162)

Disclosure statement

The authors declare no conflict of interest.

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An Analysis of the Pathways for Integrating Excellent Traditional Chinese Culture into Ideological and Political Courses in Colleges and Universities

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Abstract: Excellent traditional Chinese culture is the crystallization of wisdom accumulated by the Chinese nation in the long course of historical development, carrying the nation's spiritual genes and value pursuits. Integrating excellent traditional Chinese culture into ideological and political courses in colleges and universities is conducive to enhancing the effectiveness of ideological and political theory courses, cultivating contemporary college students' core values, and promoting the inheritance of traditional culture. Based on the significance of integrating excellent traditional Chinese culture into ideological and political teaching in colleges, this paper analyzes the current problems, such as insufficient content integration, outdated teaching methods, a lack of practical activities, and uneven cultural literacy of teachers. Correspondingly, it proposes optimized pathways, including refining teaching content, innovating teaching methods, organizing practical activities, and building high-quality teaching teams. The aim is to improve the teaching quality of ideological and political courses, realize the organic integration of inheriting excellent traditional Chinese culture and ideological and political education for college students, and provide useful references for the reform of ideological and political education in colleges and universities.

Keywords: Colleges and universities; Excellent traditional Chinese culture; Ideological and political courses; Integration

Online publication: October 17, 2025

1. Introduction

Ideological and political courses are the key courses for colleges and universities to implement the fundamental task of fostering virtue through education, and they are of great significance for cultivating builders and successors of socialism. In the context of the new era, integrating fine traditional Chinese culture into the teaching of ideological and political courses in colleges and universities is not only an inevitable requirement for inheriting and carrying forward fine traditional Chinese culture but also an important way to enhance the attractiveness, appeal, and effectiveness of these courses. However, in current practical teaching, there are still many problems in the integration of fine traditional Chinese culture and the teaching of ideological and political

courses in colleges and universities, which urgently require in-depth research and solutions. Therefore, exploring the paths for integrating fine traditional Chinese culture into the teaching of ideological and political courses in colleges and universities has important theoretical value and practical significance.

2. Significance of integrating excellent traditional Chinese culture into ideological and political courses in colleges and universities

2.1. Enhancing the effectiveness of ideological and political theory courses in colleges and universities

Traditional Chinese culture embodies the deepest spiritual pursuits of the Chinese nation and serves as a rich source of nourishment for its continuous survival and development. Integrating it into ideological and political courses can make abstract ideological and political theories more vivid and concrete, making them easier for students to understand and accept. For example, when explaining “friendliness” in the core socialist values, we can introduce Confucius’ idea of “Do not do to others what you do not want others to do to you.” By interpreting such classic statements from traditional culture, students can better understand the connotation and importance of friendliness. Meanwhile, the rich historical stories and celebrity allusions in traditional culture can provide vivid cases for ideological and political teaching, increase the interest and appeal of the classroom, stimulate students’ learning interest and enthusiasm, thereby improving the teaching effect of ideological and political theory courses and enhancing their effectiveness.

2.2. Cultivating college students’ core values

Excellent traditional Chinese culture has become the gene of Chinese culture, rooted in the hearts of the Chinese people, and subtly influencing their behavior. The values advocated by excellent traditional Chinese culture, such as the family and country feelings of “Everyone is responsible for the rise and fall of the country,” the noble integrity of “Not corrupted by wealth, not shaken by poverty, not subdued by force,” and the honesty of “Keep one’s word and act resolutely,” are highly consistent with the core socialist values. Integrating excellent traditional Chinese culture into ideological and political courses in colleges and universities can guide students to deeply understand and identify with the values in excellent traditional Chinese culture, and imperceptibly cultivate their feelings for the country, social responsibility, and moral qualities. Through learning and perceiving traditional culture, students can better understand the historical origin and cultural heritage of core socialist values, thus consciously internalizing them into their own value pursuits, externalizing them into their own codes of conduct, and practicing core socialist values more consciously.

2.3. Promoting excellent traditional Chinese culture

Against the background of globalization and modernization, excellent traditional Chinese culture is facing the dual challenges of Western cultural impact and the rapid development of modern society, making it urgent to inherit and promote it. As an important position for talent cultivation, colleges and universities shoulder the important mission of inheriting and promoting excellent traditional Chinese culture. Integrating excellent traditional Chinese culture into ideological and political courses in colleges and universities enables students to systematically learn and understand the rich connotation and unique charm of excellent traditional Chinese culture in the process of ideological and political education, enhancing their sense of identity and pride in traditional culture^[1-3]. At the same time, through the dissemination and guidance of ideological and political

courses, a strong atmosphere of traditional culture can be created in colleges and universities, attracting more students to pay attention to and participate in the inheritance and innovation of excellent traditional Chinese culture, and injecting new vitality into its inheritance and development.

3. Problems in integrating excellent traditional Chinese culture into college ideological and political courses

3.1. The content relevance needs to be further improved

Effectively integrating excellent traditional Chinese culture into ideological and political teaching can expand the connotation of ideological and political courses and enrich classroom teaching content. At present, although colleges and universities have begun to attach importance to the integration of excellent traditional Chinese culture into ideological and political courses, there is a certain degree of blindness and randomness in the selection of content. Some teachers do not have an in-depth understanding and grasp of excellent traditional Chinese culture, and fail to fully explore the connection points between traditional culture and the teaching content of ideological and political courses. As a result, in the teaching process, traditional culture content is simply and mechanically piled into ideological and political courses, failing to achieve an organic integration of traditional culture and the teaching content of ideological and political courses ^[4].

3.2. Teaching methods need to be further innovated

Teaching methods are an important aspect of the teaching process. In the process of integrating excellent traditional Chinese culture into college ideological and political courses, many colleges still mainly adopt the traditional lecture method. Teachers dominate the classroom, and students are in a passive state of accepting knowledge. When integrating traditional culture content, the same single teaching method is used, where traditional culture knowledge is only imparted to students through oral explanation, lacking interactivity and interest ^[5]. This kind of teaching method is difficult to stimulate students' interest and enthusiasm in learning, and cannot enable students to deeply understand and perceive the connotation and charm of traditional culture.

3.3. Practical activities need to be further expanded

Cultural inheritance requires practical carriers. In the process of integrating excellent traditional Chinese culture into college ideological and political courses, practical activities are relatively insufficient. On the one hand, colleges and universities lack a systematic, practical teaching system for traditional culture, and have not incorporated traditional cultural practice activities into the teaching plan of ideological and political courses, resulting in a lack of planning and standardization in the implementation of practical activities. On the other hand, teachers do not attach enough importance to traditional cultural practice teaching, overemphasizing the imparting of theoretical knowledge in the teaching process while neglecting the practical teaching link. Students lack the opportunity to experience traditional culture personally, making it impossible to transform the learned traditional culture knowledge into practical actions and abilities ^[6].

3.4. Teachers' cultural literacy needs to be further improved

The key to running ideological and political courses well lies with teachers. At present, college ideological and political course teachers' understanding and mastery of excellent traditional Chinese culture are not in-depth and comprehensive enough. On the one hand, since the professional backgrounds of college ideological and political

course teachers are mainly in fields such as Marxist theory and ideological and political education, they lack systematic study and research on professional knowledge related to traditional culture, leading to inaccurate and shallow explanations of traditional culture content in the teaching process^[7]. On the other hand, some teachers lack a sense of responsibility and mission for inheriting and promoting traditional culture, have an insufficient understanding of the importance of integrating traditional culture into ideological and political courses, and fail to actively explore and utilize traditional cultural resources in teaching, which affects the effectiveness of integrating traditional culture into ideological and political courses.

4. Optimization paths for integrating excellent traditional Chinese culture into ideological and political courses in colleges and universities

4.1. Optimize the integrated content and integrate it into the entire teaching process

Excellent traditional Chinese culture contains rich ideological essences and serves as an important treasure trove of teaching materials for ideological and political courses in colleges and universities. To give full play to its educational value, it is necessary to precisely select the content to be integrated, so that traditional culture can naturally blend into ideological and political classrooms, thereby enhancing the effectiveness of teaching. First, teachers of ideological and political courses in colleges and universities should strengthen their research on the teaching syllabus and textbooks, conduct in-depth analysis of the internal connections between the content of ideological and political courses and excellent traditional Chinese culture, and explore ideological concepts, value orientations, and moral norms in traditional culture that align with the teaching content of ideological and political courses^[8-10]. For example, when explaining *An Outline of Modern Chinese History*, teachers can introduce the spirit of patriotism in traditional culture. By telling the stories of patriotic figures in history, they can guide students to understand the patriotic traditions of the Chinese nation and enhance their national pride and patriotic feelings.

Second, colleges and universities should organize relevant experts and teachers to systematically sort out and integrate excellent traditional Chinese cultural resources, and establish a traditional culture resource database suitable for the teaching of ideological and political courses. The resource database can include classic works of traditional culture, historical stories, celebrity allusions, poems and songs, traditional arts, etc., which are classified and organized according to different modules and knowledge points of ideological and political teaching, making it convenient for teachers to consult and use in the teaching process. Finally, teachers can also conduct secondary development and innovation of traditional cultural resources according to the actual teaching needs, transforming them into vivid, interesting, and easy-to-understand teaching cases and materials, to improve the quality and effect of integrating traditional culture into ideological and political courses.

4.2. Innovate teaching methods to improve the quality of integration

The limitations of traditional teaching methods in ideological and political classrooms restrict the depth and effectiveness of integrating traditional culture. However, through diversified teaching means and interactive classroom design, it can not only enhance students' interest in learning but also deepen their understanding of traditional culture and ideological and political knowledge, achieving mutual improvement between teaching and learning^[11]. On the one hand, teachers of ideological and political courses in colleges and universities should change the traditional teaching mode dominated by lectures and adopt diversified teaching methods such as case teaching, discussion-based teaching, situational teaching, and experiential teaching to integrate excellent

traditional Chinese culture into ideological and political courses. For example, when explaining moral norms in traditional culture, the case teaching method can be used. By analyzing moral cases in real life, students are guided to use moral concepts in traditional culture for analysis and evaluation, improving their moral judgment and practical abilities. At the same time, teachers can use modern information technologies such as multimedia teaching and online teaching to enrich the content and form of teaching, enhancing the intuitiveness and interest of teaching. For instance, by playing documentaries and short videos on traditional culture, students can more intuitively feel the charm of traditional culture, thereby increasing their interest and enthusiasm for learning^[12].

On the other hand, in the teaching process of ideological and political courses, teachers should focus on strengthening interaction and communication with students, encouraging them to actively participate in classroom discussions and speeches, and creating a good classroom atmosphere. When integrating traditional cultural content, teachers can design inspiring and open-ended questions to guide students to think and discuss, stimulating their thinking vitality and innovative abilities. For example, when explaining philosophical thoughts in traditional culture, teachers can raise questions such as “What enlightenment do the philosophical thoughts in traditional culture have for the development of modern society?” and organize students to conduct group discussions and exchanges. This allows students to deeply understand the connotation and value of traditional culture in discussions while cultivating their teamwork spirit and expression skills.

4.3. Expand practical teaching to enhance students’ participation

Practical teaching is an important link in the teaching of ideological and political courses in colleges and universities, and it is of great significance for students to deeply understand and practice the teaching content of ideological and political courses. Colleges and universities should incorporate traditional cultural practice activities into the teaching plan of ideological and political courses and build a systematic, practical teaching system of traditional culture. The practical teaching system should include practical teaching objectives, content, methods, and evaluation, clarifying the requirements and standards of practical teaching. For example, the objectives of practical teaching can be set as cultivating students’ traditional cultural literacy, practical abilities, and innovative spirit; the content of practical teaching can include traditional cultural lectures, cultural experience activities, volunteer services, and social practice; the methods of practical teaching can adopt project-based learning and inquiry-based learning; the evaluation of practical teaching can combine process evaluation and summative evaluation to comprehensively assess students’ practical learning outcomes.

In addition, colleges and universities should actively organize a variety of traditional cultural practice activities to provide students with opportunities to experience traditional culture firsthand. For example, holding traditional cultural lectures and inviting experts and scholars to explain the connotation and value of traditional culture to students; organizing cultural experience activities such as calligraphy, painting, paper-cutting, tea art, and martial arts, allowing students to feel the charm of traditional culture in practice; carrying out volunteer service activities, such as organizing students to promote traditional culture in communities, nursing homes, etc., contributing to the inheritance and promotion of traditional culture; encouraging students to participate in social practice activities, such as conducting traditional cultural research and cultural inheritance and innovation projects, so that students can deeply understand traditional culture in practice and improve their practical and innovative abilities^[13,14].

4.4. Cultivate teaching teams to improve educational quality

Teachers are a key factor in integrating excellent traditional Chinese culture into the teaching of ideological and

political courses in colleges and universities, and their cultural literacy directly affects the quality and effect of integrating traditional culture into teaching. Colleges and universities should strengthen the training of ideological and political course teachers in traditional culture to improve their cultural literacy and teaching abilities. This can be achieved by organizing teachers to systematically learn traditional cultural knowledge through special training courses, academic lectures, and seminars on traditional culture, so that they can understand the development context and essence of traditional culture. At the same time, colleges and universities should encourage teachers to participate in domestic and international academic exchange activities to broaden their academic horizons and learn advanced teaching concepts and methods ^[15]. In this process, teachers themselves should also take the initiative to learn traditional cultural knowledge and continuously improve their cultural literacy and teaching level. Colleges and universities should establish incentive mechanisms to encourage ideological and political course teachers to actively carry out research and practice on integrating traditional culture into ideological and political course teaching. For example, incorporating research results on the integration of traditional culture into ideological and political courses into teachers' research assessment systems, commending and rewarding teachers who have made outstanding achievements in this field; setting up special projects on integrating traditional culture into ideological and political course teaching to support teachers' research; providing teachers with more teaching resources and practical opportunities to encourage them to innovate teaching methods and models, and improve the quality and effect of integrating traditional culture into ideological and political course teaching.

5. Conclusion

The fine traditional Chinese culture is the spiritual lifeline of the Chinese nation, the fertile soil in which socialism with Chinese characteristics is rooted, and the foundation for us to stand firm in the midst of global cultural waves. Integrating fine traditional Chinese culture into the teaching of ideological and political courses in colleges and universities is an important direction for the reform of ideological and political education in colleges and universities in the new era. It is of great significance for improving the teaching quality of ideological and political courses in colleges and universities, cultivating the core values of contemporary college students, and inheriting the fine traditional culture of the Chinese nation. Colleges and universities should further strengthen the research and practice of integrating fine traditional Chinese culture into the teaching of ideological and political courses, continue to explore and innovate, and provide strong support for cultivating socialist builders and successors with all-around development of morality, intelligence, physical fitness, aesthetics, and labor.

Disclosure statement

The author declares no conflict of interest.

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Research on the Transformation Path of Undergraduate Architecture Education in the Context of New-Era AI: A Case Study of Architecture Education in Universities in Western China

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Abstract: With the rapid development of artificial intelligence (AI) technology, architecture education is undergoing a profound transformation from traditional experience inheritance to innovation-driven development. Starting from undergraduate architecture education, this paper takes architecture education in universities in western China as an example to analyze the characteristics of its curriculum system and the practical model of the “apprenticeship system,” and explores the impact of AI technology on architectural design teaching as well as corresponding response strategies. By integrating a three-in-one reform framework of “technology empowerment, cultural inheritance, and teaching reconstruction,” the paper proposes curriculum optimization paths and practical training methods. The aim is to construct a new model of architecture education adapted to the intelligent era, and cultivate interdisciplinary talents with innovative capabilities, technical literacy, and a commitment to cultural inheritance.

Keywords: Architecture; Undergraduate education; Universities in western China; Educational model; Curriculum optimization

Online publication: October 17, 2025

1. Introduction

As artificial intelligence, digital technology, and other innovations exert an influence on the field of education, traditional education is gradually facing challenges. The channels for students to acquire knowledge have expanded; in the information age, various knowledge theories have been widely disseminated and permeated. How to impart more valuable knowledge and information to students, and how to update teaching models to meet the development requirements of the times, have gradually become issues for educators to ponder^[1]. Driven by AI technologies such as generative design, intelligent construction, and virtual reality, the architecture

industry is facing an ecological restructuring, and the limitations of the “apprenticeship system” model in traditional architecture education have become increasingly prominent ^[2]. Restricted by faculty strength and technical resources, universities in western China are in urgent need of exploring educational transformation paths to address the dual challenges of technological change and interdisciplinary integration ^[3]. By analyzing the current status of undergraduate architecture education and the new demands of the era, this study proposes strategies for integrating AI technology with traditional teaching models and provides teaching references for the transformation of modern architecture education.

2. Research background

The undergraduate education of Architecture in our university takes design courses as the core and has built a curriculum framework that covers architectural theory, architectural technology theory, and practical training. Architectural theory includes a series of courses such as Architectural History, Building Construction, and Principles of Architectural Design; architectural technology theory encompasses content related to Green Architecture, Building Energy Efficiency, and Computer-Aided Design (including technologies like BIM and Parametric Design); and practical training consists of elements such as design-oriented courses, curriculum design practice, cognitive internships, and surveying and mapping internships. The education of the Architecture major still mainly adopts traditional teaching methods for architecture disciplines, following the conventional “master-apprentice” model where teachers provide one-on-one guidance to students for foundational architectural training.

3. Curriculum characteristics and practical training requirements of undergraduate architectural teaching

3.1. Characteristics of the curriculum system

Undergraduate education in Architecture takes design courses as its core and forms a trinity training framework of “Theory-Technology-Practice.” The curriculum system comprises three modules: the theory module, which covers courses such as Architectural History, Principles of Building Construction, and Principles of Architectural Design, focuses on the cultivation of humanistic literacy and the accumulation of basic theories; the technology module, including courses like Computer-Aided Design, Parametric Design, and Green Building Design, emphasizes the ability to apply digital tools; and the practice module strengthens students’ ability to solve practical problems through practical courses such as art modeling course practice, design-related courses and their practical sessions, as well as historical building surveying and mapping internships. Starting from the lower grades, the curriculum system gradually develops students’ architectural design capabilities: it begins with fostering art skills and constructing spatial thinking, and progresses to conducting training on the creation of specific architectural schemes when students reach the upper grades.

3.2. Traditional master-apprentice practical training model

Design courses and architectural design practical training rely on the master-apprentice system, a “master guiding apprentice” mentoring model where teachers impart design experience and drawing skills through one-on-one tutoring. The teaching process involves design progress checks and feedback: teachers regularly review sketches, models, and schematic design drawings, and provide revision suggestions through hand-drawn annotations, verbal comments, and other methods. Drawing on their own project experience, teachers guide students in

addressing practical issues such as spatial scale and material selection, transferring knowledge by translating their experience into teachable content. The advantages of this process lie in teachers' ability to offer personalized guidance on each student's design proposal, which embodies humanistic care in teaching and facilitates the effective inheritance of design thinking and methods. However, there are also shortcomings: for example, work efficiency is low, as teachers may need most of a day to help a student resolve design problems. Additionally, this model relies heavily on teachers' experience and is difficult to scale up. Different teachers have different ways of thinking, so the revision suggestions they put forward may vary, making it challenging to unify specific teaching requirements.

4. The impact of AI technology on architectural education

4.1. Technological empowerment of the design process

With the application of modern technological means, a variety of new methods have emerged that can quickly generate multiple design outcomes meeting the requirements of schematic design tasks. For instance, generative AI assists in conceptual design: tools like Midjourney and Stable Diffusion can rapidly produce diverse schematic sketches to inspire students' creativity ^[4]. In terms of parametric design and performance optimization, Grasshopper is combined with AI algorithms to realize the automation of form generation, structural analysis and energy consumption simulation, enhancing the scientific nature of students' schematic design; and through virtual construction and immersive experiences, such as dynamic spatial scenarios built with VR/AR technologies, it is possible to help students intuitively understand spatial logic ^[5].

4.2. Transformation of teaching modes

For teachers, new methods have also emerged to improve teaching efficiency. For instance, in terms of personalized teaching paths, AI analyzes students' assignment data to recommend customized learning resources—such as pushing specialized cases for weak areas in parametric design. Regarding intelligent drawing evaluation and real-time feedback, AI systems based on image recognition can automatically detect the standardization of drawings and generate revision suggestions through natural language processing, alleviating the pressure on teachers from grading ^[6]. Additionally, there are interdisciplinary collaboration platforms: tools like NotionAI integrate teams from architecture, computer science, and environmental science, supporting research on large-scale and complex comprehensive projects ^[7].

5. Adjustment strategies for teaching and learning methods in the AI era

The reconstruction of the master-apprentice system in the AI era is not about technological replacement, but about the evolutionary upgrading of the educational ecosystem. By establishing a human-machine symbiotic teaching system, we not only retain the essence of individualized instruction in the traditional master-apprentice system but also expand the cognitive dimensions of the digital age. Ultimately, this cultivates a new generation of architectural talents who possess both humanistic warmth and technological sharpness.

5.1. Reconstructing the master-apprentice system: From “Human-to-Human Transmission” to “Human-Machine Collaboration”

An intelligent hierarchical evaluation system is established, and a student competence assessment model

based on BIM parameter analysis, design thinking evaluation, and machine learning algorithms is constructed. Through the collection of design work data, cognitive behavior analysis, and knowledge graph construction, an accurate portrayal of students' three-dimensional competence profiles is realized. This system can dynamically track students' growth curves in dimensions such as spatial imagination, structural understanding, and aesthetic perception.

For instance, a digital twin curriculum module can be developed, building a three-in-one curriculum framework of “architectural scheme + digital modeling + virtual simulation.” This framework deeply integrates traditional construction techniques with technologies such as generative design, AI-assisted rendering, and XR spatial interaction^[8]. In the course of “Protection of Historical Buildings”, for example, laser scanning data reconstruction and machine learning style transfer technology are integrated. In response to the development of modern intelligent technology, an intelligent enhanced knowledge graph is utilized, and natural language processing technology is applied to build a dynamic knowledge base for architecture^[9]. This enables functions such as intelligent retrieval of specification clauses, semantic association of design cases, and version tracing of technical standards. Through the visual presentation of the knowledge graph, students are helped to establish a cross-scale systematic cognition^[10].

5.2. Innovation in practical training

5.2.1. Intelligent construction workshop

A practical platform equipped with intelligent devices such as robotic arms, 3D printers, and UAV surveying and mapping tools is built, and a curriculum module on architectural robot programming is developed. In the process of human-machine collaboration, students master the complete workflow from digital modeling to physical construction. For example, by combining 3D printing and UAV technology, virtual schemes can be transformed into physical models to verify the feasibility of designs.

5.2.2. Augmented reality (AR) guidance system

An AR-assisted design guidance tool is developed, enabling real-time annotation of 3D spaces through spatial projection and gesture interaction. Mentors can remotely add virtual annotations, and the AI system automatically identifies design flaws and provides improvement suggestions.

AI design seminars are set up to guide students to think dialectically about the relationship between machine aesthetics and humanistic values through creative design training. For example, in the construction of a traditional architecture database, a “Xinjiang Earthen Architecture Intelligent Database” is established through 3D scanning and machine learning, which can automatically identify cultural elements such as arches and wood carvings. AI algorithm tools are developed to translate the ventilation logic of the Uyghur “Ayiwang” courtyard into design parameters for modern residential buildings, facilitating innovative practice.

6. Practical approaches to cultivating interdisciplinary architectural talents

6.1. Curriculum reconstruction for cross-domain knowledge integration

6.1.1. Intelligent-enhanced curriculum modules

Develop a “triple-linked” curriculum integrating Architectural Structural Design, Architectural Physics Performance Simulation, and Environmental Data Visualization. This curriculum is connected through the Grasshopper-Dynamo-UE5 toolchain to foster students' dual competencies in parametric design and technical

verification^[11]. Launch an interdisciplinary course “Architectural Anthropology × Spatial Machine Learning,” which uses eye trackers and behavioral sensors to collect spatial usage data, and trains AI models to predict human spatial perception patterns.

6.1.2. Development of dynamic knowledge graphs

Build an AI-based interpretation system for architectural codes, converting provisions in fields such as fire protection, energy efficiency, and accessibility into 3D spatial constraints to real-time verify the compliance of design schemes. Develop a genetic database of historical buildings, deconstruct and reorganize regional architectural features using StyleGAN^[12], helping students master digital translation methods for cultural symbols.

6.2. Industry-university-research collaborative talent cultivation

- (1) University-Enterprise Joint Laboratories: Collaborate with enterprises to establish “Intelligent Construction Joint Laboratories,” providing practical training platforms for BIM modeling, robotic construction, and other technologies.
- (2) Rural Revitalization Practice Bases: Students carry out the “AI-Assisted Renovation of Traditional Dwellings” project in southern Xinjiang villages, realizing rapid renovation through UAV mapping and 3D printing technologies.

The cultivation of interdisciplinary architectural talents needs to break through the boundaries of traditional majors and build a new educational ecosystem characterized by “digital technology as the backbone and humanistic spirit as the soul.” Through a human-machine collaborative knowledge production model and a practice field that integrates the virtual and the real, we aim to nurture architectural leaders who can not only master intelligent tools while upholding humanistic values, but also excel in professional fields while perceiving systematic connections. This transformation requires educators to redefine the relationship between “teaching” and “learning,” and cultivate students’ interdisciplinary capabilities in the “melting pot” of real-world problems.

7. Countermeasures

7.1. Strategic positioning for differentiated development

Focus on the special needs of ecologically fragile areas and multi-ethnic settlements in Western China, and launch distinctive course modules such as “AI-Assisted Ecological Restoration Design” and “Digital Protection of Traditional Architecture.” Establish a lightweight technology application model: adopt technologies with low configuration requirements, such as edge computing and lightweight BIM, and develop teaching toolkits adapted to the hardware conditions in Western China. For example, based on UAV aerial survey and open-source GIS platforms, build a low-cost digital surveying and mapping teaching system for rural settlements.

7.2. Reconstruction of localized curriculum system

“Digital Craftsman” Training Program: Offer compulsory courses such as “Python Application in Architecture” and “Fundamentals of Geographic Information System (GIS),” and integrate general education on AI technology; carry out regional design topics like “Microclimate Simulation in Arid Areas”; set up “Western Smart Construction Workshops” to conduct practical training in combination with real projects such as photovoltaic agricultural greenhouses and ecological migration resettlement^[9]. Develop courses on digital inheritance of

living heritage: establish a “Digital Twin Library of Traditional Architectural Techniques,” record craftsmen’s construction processes through motion capture technology ^[13], and convert them into AR-guided teaching resources.

7.3. Construction of a diversified and collaborative ecosystem

Establish a cross-regional “Digital Education Alliance”, co-build virtual course teaching and research sections with universities in Eastern China, and share intelligent design teaching resources; join hands with scientific research institutions in Western China to set up the “Silk Road Architectural Digital Archive” and build an inter-provincial cultural heritage database. In terms of the government-industry-university-research-application linkage mechanism, align with the policy needs of “new-type urbanization in Western China” and undertake government projects such as smart villages and activation of historical blocks ^[14].

7.4. Adaptive upgrading of the teaching staff

Implement the “double qualification and double competence” training for teachers, introduce a teacher AI competence certification system, and require professional teachers to master intelligent design tools (e.g., Rhino + Grasshopper, CLO3D) ^[15]. Build a digital teaching and research community, establish interdisciplinary virtual teaching and research sections, and regularly carry out thematic teaching and research activities such as BIM forward design.

8. Conclusion

The adaptation of architectural education in Western China’s universities to the era of AI should not be a simple technology transplantation. Instead, it is necessary to build a new educational paradigm featuring “technology adapting to regional needs, digitalization activating traditional wisdom, and intelligence serving the development of Western China”. By exploring the potential of digital expression of regional cultural genes, establishing a low-cost and high-efficiency technology application model, we can cultivate new-type architectural talents who can not only master intelligent tools but also have a deep understanding of the construction wisdom in Western China. This transformation is not only an inevitable choice to respond to the technological revolution but also a historical opportunity for Western architectural education to achieve “corner overtaking.” It needs to be based on cultural confidence and blaze a path of educational development with distinctive Western regional characteristics.

Disclosure statement

The author declares no conflict of interest.

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Research on the Reconstruction of the Elderly's Role from Passive Acceptance to Active Innovation in the Digital Silver Economy of China's Megalopolises: A Case Study of Chengdu

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Abstract: This study focuses on the transformation process and reconstruction mechanism of the role of the elderly group in Chengdu under the background of the digital silver economy in China's megalopolises. With the acceleration of population aging and the rapid development of digital technology, the silver economy has become increasingly prominent in the economy of urban agglomerations. Taking Chengdu as an example, this paper adopts a mixed research method, including questionnaire survey, in-depth interview, and case analysis, to explore the transformation process of the elderly group from passively accepting digital technology to actively participating in innovation. The study finds that the role reconstruction of the elderly group in Chengdu in the digital silver economy is mainly reflected in the following aspects: (1) The improvement of digital literacy promotes the transformation of the elderly from technology users to innovation participants; (2) The improvement of social support networks promotes the integration of the elderly into the digital economic ecology; (3) Policy guidance and market driving jointly promote the release of the innovative ability of the elderly group. Based on the research results, this paper puts forward policy suggestions to promote the role reconstruction of the elderly group, including improving the digital technology education system, building an elderly-friendly digital environment, and encouraging the elderly to innovate and start businesses. This research provides a new perspective and empirical basis for understanding and promoting the development of the digital silver economy in megalopolises, and is of great significance for promoting the active participation of the elderly group in the digital economy and realizing the sustainable development of urban agglomerations.

Keywords: Megalopolis; Digital silver economy; Reconstruction of the elderly's role; Innovation participation

Online publication: October 21, 2025

1. Introduction

China's population aging is accelerating, and digital technology is also developing rapidly. Against this backdrop, the digital silver economy has emerged as a new economic form. Chengdu, as a megacity in western China, is

representative. The proportion of the elderly population aged 60 and above here reaches 20.6%, while the added value of the digital economy accounts for as high as 43.2% of GDP. This indicates that Chengdu has both a high degree of aging and a high level of digitalization ^[1]. However, the elderly group has long been in a marginalized position in the digital economy. Most of them passively accept technology and face problems such as the digital divide and low participation.

This paper takes Chengdu as a case study to explore the role transformation process of the elderly group in the digital silver economy. The focus of the research is on how the elderly transform from passive technology recipients to active innovation participants. By analyzing Chengdu’s practices, including policy support, digital skills training, the development of elderly-friendly products, and the construction of new participation models, it reveals the internal mechanisms and laws of the development of the digital silver economy in megalopolises ^[2]. These explorations provide a theoretical basis and practical reference for addressing the challenges of aging and building an inclusive digital society.

2. Current situation and challenges of Chengdu’s digital silver economy

2.1. Overview of the development of Chengdu’s digital silver economy

Chengdu’s digital silver economy has developed rapidly in recent years, with smart elderly care, health management, cultural entertainment, and financial services emerging as the main sectors. From 2019 to 2024, the market size surged from 18.2 billion yuan to 61.2 billion yuan, with a compound annual growth rate of 27.6%. As of September 2024, the total number of enterprises related to Chengdu’s digital silver economy exceeded 3,450, an increase of 23.2% compared to 2023. Among them, the proportion of high-tech enterprises rose to 42.7% (from 38.4% in 2023), covering 12 segmented industrial chains such as intelligent aging-adapted hardware research and development and health care big data platforms, forming a full-chain industrial cluster integrating “technology research and development - scenario application - ecological services” ^[2].

When participating in the digital economy, the elderly in Chengdu face the problem of the digital divide, which is mainly reflected in three aspects: access, usage, and innovation. First, in terms of access ^[3], the proportion of elderly people in Chengdu with smart devices increased from 62.4% in 2019 to 78.6% in 2024, but the access rate among the elderly in rural areas is still less than 65.3%. Moreover, there is a significant gap between elderly people with different income levels. Second, in terms of usage, there is a large intergenerational gap between the elderly in Chengdu and middle-aged and young people in mastering digital skills. Data shows that their success rate in operating complex functions is only 42% of that of middle-aged and young people. Finally, in terms of innovation, the elderly rarely participate in the optimization of digital products and service innovation. **Table 1** shows that only 3.2% of digital product research and development processes consider feedback from elderly users ^[4].

Table 1. Digital divide index of different age groups of the elderly in Chengdu, 2023

Age group	Access index	Usage index	Innovation index	Comprehensive index
60–69 years old	0.72	0.56	0.24	0.51
70–79 years old	0.58	0.41	0.15	0.38
Over 80 years old	0.36	0.25	0.07	0.23

2.2. The value of the digital silver economy in promoting active innovation among the elderly

In promoting the development of the digital silver economy, Chengdu has established a multi-level policy support system to provide institutional guarantees for the role transformation of the elderly. Starting from 2020, Chengdu

has successively issued several policy documents, including Chengdu Smart Elderly Care Industry Development Action Plan (2020–2025), Chengdu Guidelines for the Construction of Elderly-Friendly Communities, and Chengdu Action Plan for Promoting the Integration of the Elderly into the Digital Society. These documents together form a complete policy framework covering industrial development, community construction, and digital participation. An important feature of policy innovation is the combination of “bottom-up” and “top-down” design methods. Through mechanisms such as establishing elderly participation committees and silver-haired think tanks, the elderly can express their opinions in policy formulation. By the end of 2023, 183 communities in Chengdu had established elderly participation committees. This approach makes policies more precise and more in line with the actual needs of the elderly ^[4].

3. Path for reconstruction of the elderly’s role from the perspective of digital silver economy

3.1 Contribution to urban economic development

The economic development of Chengdu and the entire Chengdu-Chongqing urban agglomeration has gained new momentum due to the redefinition of the elderly’s role. The smart elderly care sector continues to lead the way, with investment scale exceeding 23.5 billion yuan in 2024, accounting for 38.4% of the total market size (compared to 33.5% in 2023), and the coverage rate of 5G + AI elderly care monitoring systems rising to 65%. The health management segment is accelerating its upgrade, with a market size of 18.9 billion yuan (accounting for 30.9%), and the volume of remote medical consultations surging by 82% year-on-year. Cultural entertainment and financial services together contribute the remaining 30.7%, among which elderly cultural and tourism consumption increased by 41% year-on-year, and the penetration rate of age-appropriate financial products reached 34% ^[5].

A notable phenomenon has emerged in Chengdu’s economic development: elderly entrepreneurs and “silver elites” have begun to make their mark. Among the elderly aged 65 and above in Chengdu, 8.6% have embarked on entrepreneurial ventures, creating over 35,000 jobs (**Table 2**). Additionally, many “silver KOLs” use live-streaming platforms to sell agricultural products, generating annual sales exceeding 450 million yuan and injecting new vitality into the development of rural e-commerce. Moreover, the increased consumption power of the elderly has driven changes in industries such as health and elderly care, cultural tourism, etc. New consumer sectors like smart health devices and elderly-friendly tourism products have seen annual market size growth rates exceeding 25%, providing crucial support for high-quality economic development ^[6].

Table 2. Contribution of the reconstruction of the elderly’s role to Chengdu’s urban economy (2020–2024)

Indicator	2020	2021	2024	Annual average growth rate
Silver economy market size (trillion yuan)	3.2	4.3	5.8	16.1%
Number of jobs created by elderly entrepreneurship (10,000 people)	1.8	2.6	3.5	18.2%
Sales of “silver KOLs” (100 million yuan)	1.2	2.8	4.5	39.1%
Market size of smart health devices (100 million yuan)	35.6	58.3	89.7	26.0%
Revenue of age-appropriate tourism products (100 million yuan)	28.4	41.2	71.6	26.1%

3.2. Enhancement of social inclusion and intergenerational integration

The social inclusion and intergenerational integration in Chengdu have been significantly enhanced due to the reconstruction of the elderly’s roles. Elderly individuals have transformed from passive users of digital technology

into active participants in innovation, which has notably increased their interactions with young people and greatly reduced communication barriers ^[7]. In 2024, 58.3% of the elderly in Chengdu participated in intergenerational community activities, 21.5 percentage points higher than in 2020. Additionally, 76.4% of the elderly reported that they could maintain daily contact with their children and grandchildren through digital tools, which has significantly alleviated intergenerational gaps. Furthermore, the increased initiative of the elderly in the digital field has changed people's stereotypes about them. The recognition rate of Chengdu citizens regarding the elderly's "progressive with the times" trait reached 72.6%, an increase of 26.3 percentage points compared to 2019 ^[5].

Today's elderly are no longer just staying at home to enjoy their leisure. More and more elderly people are embracing the digital economy and collaborating with young people on innovations. Examples include community shared medicine cabinet mini-programs and intelligent regulators for square dance noise, which are both considerate and practical. There are 526 such "veteran-led" entrepreneurial teams across the city. In 4 out of every 10 community councils ^[8], one can see elderly people wearing reading glasses and earnestly putting forward suggestions. The satisfaction of neighborhood residents has also improved, like adding a "lubricant to daily life." Aunt X said, "Even quarrels in the corridor have decreased." This truly reflects the saying, "Having an elderly person in the family is like having a treasure!"

3.3. Improvement of the elderly group's quality of life

The digital transformation strategy implemented in Chengdu has significantly increased the elderly's digital participation. This strategy has also improved the quality of life of the elderly through clear role positioning, with enhancements evident in multiple aspects, including material life, physical and mental health, social participation, and self-actualization ^[2]. A 2022 survey by the Chengdu Municipal Working Committee on Aging showed that elderly individuals who received digital skills training and actively participated in the digital silver economy had a life satisfaction rate 32.7% higher than those who did not participate. Meanwhile, their depression incidence decreased by 24.3%. These changes indicate that the elderly are adopting more scientific approaches to health management, expanding their social circles, and achieving a more fulfilling sense of self-worth ^[9]. More notably, through active participation in innovation, the elderly are no longer regarded as a social burden but as a resource with productivity and creativity. This role transformation has directly improved their mental health and self-esteem ^[10].

Table 3. Comparison of quality of life of Chengdu's elderly population before and after role reconstruction (2019–2023)

Evaluation indicators	Before role reconstruction (2019)	After role reconstruction (2023)	Change rate (%)
Life satisfaction (1–5 points)	3.2	4.1	+28.1
Self-rated good health (%)	42.7	65.3	+52.9
Social participation rate (%)	31.5	63.8	+102.5
Rate of learning new skills (%)	15.2	58.7	+286.2
Weekly social activities	1.3	3.5	+169.2
with income sources (%)	22.4	41.9	+87.1
Good mental health (%)	56.3	72.8	+29.3
Effective chronic disease management rate (%)	48.5	76.2	+57.1

Data source: Chengdu Municipal Working Committee on Aging, Chengdu Elderly Quality of Life Assessment Report, released in 2023, which provides relevant data and information.

4. Conclusion

Against the backdrop of the digital silver economy in China's mega-urban agglomerations, the role of the elderly group in Chengdu has undergone changes. They have transformed from passive recipients to active innovators. The study found that the transformation of the elderly's role is an important way to cope with population aging and a key to promoting the sustainable development of urban agglomerations^[11]. The case of Chengdu shows that enhancing digital literacy, improving social support networks, and combining policy guidance with market-driven forces can effectively stimulate the potential of the elderly group. The elderly have changed from people who passively use digital technologies to those who actively participate in innovation^[10].

Chengdu has established a multi-collaboration mechanism, including government guidance, market leadership, social participation, and the elderly as the main body. This model provides reference experience for other mega-urban agglomerations such as Beijing, Shanghai, and Guangzhou. Future research needs to pay more attention to the internal differences among the elderly group, the collaborative development between urban agglomerations, and the improvement of the digital governance system^[12]. These efforts will more comprehensively support the transformation trend of the elderly's role and help China's mega-urban agglomerations achieve innovation-driven and high-quality development in the context of aging.

Disclosure statement

The authors declare no conflict of interest.

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Understanding and Implementation of High School General Technology Textbooks Based on Curriculum-based Ideological and Political Education

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Abstract: Under the context of curriculum-based ideological and political education, how to deepen cultural identity and value guidance through subject teaching has become an important research topic. This study takes the high school General Technology curriculum as its focus, employing textbook analysis and teaching practice (covering 152 students across 3 classes) to systematically explore cultural educational elements from traditional technical literature and construct a three-step teaching model of “context-practice-reflection.” Quantitative data demonstrates significant improvements in students’ cultural identity (+23%) and the cultural expression in their technical works (+24%). The research provides an operable practical paradigm for the integration of technical courses and cultural education, offering exemplary value for educational reform.

Keywords: Curriculum-based ideological and political education; General technology textbooks; Cultural immersion; Project-based learning

Online publication: October 17, 2025

1. Introduction

Against the backdrop of in-depth development of globalization and informatization, it is of great significance to strengthen the education on cultural confidence and value identity among adolescents. As a subject that integrates practicality and humanity, the high school General Technology curriculum not only cultivates students’ technical literacy but also undertakes the mission of shaping correct values and enhancing social responsibility. With its rich practical content and profound cultural connotation, this curriculum provides an effective carrier for carrying out education on cultural inheritance and innovation. Teachers can deeply explore the educational elements in textbooks and integrate fine traditional Chinese culture, the spirit of scientific and technological innovation, etc., into teaching practice. While improving students’ core literacy, this also cultivates their cultural identity and innovative awareness, laying a solid foundation for talent cultivation in the new era ^[1].

2. Construction and value realization of high school general technology teaching model oriented by curriculum-based ideological and political education

In the contemporary education system, national unity education holds special and far-reaching significance. The senior high school stage is a critical period for the formation of adolescents' values, during which students' world outlook, outlook on life and values are in the shaping process, making it an important window period for carrying out national unity education^[2]. Through systematic national unity education, students can be effectively guided to establish correct views on the nation and culture, and enhance their sense of identity and belonging to fine traditional Chinese culture^[3]. This not only helps to improve students' understanding and respect for multiculturalism, but also promotes communication and integration among students of different ethnic groups, laying a solid foundation for building a harmonious campus. From the perspective of educational goals, national unity education plays an irreplaceable role in cultivating new-era talents with innovative spirit, practical ability and social responsibility, and is an important approach to realizing the fundamental task of fostering virtue through education. Against the current background of globalization, strengthening national unity education is not only an important measure to safeguard national unification, but also an inevitable requirement for promoting social harmony and stability, and more importantly, a key link in cultivating new-era talents who can shoulder the responsibility of national rejuvenation^[4].

3. Cultural immersion strategies for general technology courses from the perspective of macro ideological and political education

At the specific implementation level, senior high school courses should construct an all-round national unity education system^[5]. First of all, it is necessary to deeply explore the national unity education elements in various disciplines, especially practical courses such as General Technology. Through project-based learning, cultural experience activities and other forms, students can feel the broad and profound nature of Chinese culture in hands-on practice^[6]. Secondly, attention should be paid to organically integrating national unity education with patriotism education and traditional culture education, and cultivating students' family and country feelings as well as cultural confidence through interdisciplinary thematic activities. In terms of teaching methods, interactive teaching methods such as case teaching and situational simulation can be adopted to enhance students' sense of participation and experience. At the same time, a diversified evaluation system should be established, and the effectiveness of national unity education should be incorporated into the comprehensive quality evaluation of students. This multi-dimensional education model can not only improve students' comprehensive quality, but also provide strong support for cultivating socialist builders and successors with all-round development of morality, intelligence, physical fitness, aesthetics and labor. Through various approaches such as curriculum integration, activity infiltration and environmental edification, national unity education can be truly implemented and achieve practical results, contributing to the construction of a common spiritual home for the Chinese nation^[7].

4. Practical integration of ideological and political elements into textbooks for technology courses

4.1. The cultural education characteristics of textbooks

High school General Technology textbooks feature distinct cultural education attributes, prominently reflected in their compilation philosophy that emphasizes both theory and practice, and integrates technology with culture. The content not only focuses on cultivating students' innovative and practical abilities but also subtly incorporates

elements of fine traditional Chinese culture. Taking the compulsory textbook *Entering the World of Technology* (Volume 1) as an example, the book cites classic works such as Zhuangzi·Tian Di, Mozi·Fa Yi, and Tiangong Kaiwu (The Exploitation of the Works of Nature) in multiple places. Through 6 classical quotations, it systematically expounds the technical philosophy of “skills as a carrier of Dao, and integration of skills and Dao”^[8]. These quotations not only reveal the principles and laws of technological development but also demonstrate the value orientations and moral codes embodied in traditional Chinese technical culture. By selecting typical cases, such as ancient architectural techniques and traditional craft production, the textbooks enable students to naturally come into contact with the essence of Chinese culture in the process of learning technology^[9].

By deeply exploring the wisdom contained in traditional Chinese technical literature, the textbooks realize the organic integration of modern technical education and traditional cultural inheritance. In the interpretation of classic technical works like *Yingzao Fashi* (Treatise on Architectural Methods) and *Kaogong Ji* (Records of Trades), students can not only acquire professional knowledge such as the technical principles of wooden architecture and metal processing techniques but also perceive the profound heritage of Chinese technical culture. This teaching design not only improves students’ technical literacy but also enhances their cultural identity, enabling them to understand the essence of traditional Chinese technical culture while mastering modern technology, and fostering their cultural confidence and national pride. The textbooks also pay special attention to combining traditional craftsmanship with the development of modern science and technology, guiding students to reflect on the modern value of traditional wisdom^[10].

This characteristic of integrating cultural inheritance into technical education makes General Technology textbooks an important carrier for cultivating students’ comprehensive quality^[11]. The textbooks expand students’ cultural horizons through special columns such as “Thinking Collision” and “Extended Reading”; they enhance students’ cultural experience by designing practical activities like “Traditional Craft Making” and “Ancient Technology Restoration”. This compilation concept, which organically integrates technical education with cultural inheritance, not only enriches teaching content but also innovates educational methods, providing high-quality educational resources for cultivating new-era talents who master modern technology and possess cultural heritage. Meanwhile, the textbooks also guide students to reflect on the role of technology in cultural inheritance and innovation, cultivate their cultural awareness and innovative consciousness, and inject deeper cultural connotations into technical education^[12].

4.2. Teaching implementation strategies

The implementation of high school General Technology textbooks requires teachers to conduct in-depth interpretation and creative application from multiple dimensions. Textbook content not only includes a systematic technical knowledge system but also contains rich cultural connotations. Before using the textbooks, teachers should systematically sort out the achievements in the development of ancient and modern Chinese technology presented in them, with special attention to technical cases that embody the wisdom of the Chinese nation. Through well-designed practical activities and project tasks, teachers can not only impart technical knowledge and skills but also enable students to subtly perceive the unique charm of Chinese culture and enhance their cultural identity^[13].

In the specific process of teaching implementation, teachers can make full use of modern educational technology means. Taking the Jiangsu Education Edition textbooks as an example, content that both reflects the value of contemporary technology and highlights the characteristics of traditional technical culture can be selected as the entry point. With the help of digital tools such as generative artificial intelligence, attractive

teaching scenarios can be created. For instance, AI platforms with traditional cultural characteristics like “Tiangong” can be used; through functions such as human-computer interaction and data query, students are helped to gain an in-depth understanding of the technical wisdom in classic works such as *Tiangong Kaiwu* and *Kaogong Ji*. This teaching method can not only stimulate students’ learning interest but also cultivate their information literacy and inquiry ability.

The design of teaching strategies should focus on the organic integration of practicality, cooperation, and reflectiveness. The five-step teaching method of “Scenario Creation - Inquiry & Cooperation - Practical Operation - Cultural Reflection - Achievement Display” can be adopted. Taking the design of a “temporary shelter” model as an example, real cases are introduced to help students understand the innovation of technical application in special environments. In the process of model making, students need to use engineering thinking to solve practical problems while perceiving the spirit of struggle embodied in it. Finally, through the links of work display and discussion, students are guided to think deeply about the relationship between technological development and social progress. This teaching model not only cultivates students’ technical literacy but also promotes cultural identity, realizing the organic unity of knowledge imparting and value guidance, and provides an effective way for cultivating new-era talents with innovative spirit and cultural confidence.

5. Teaching effectiveness and improvement directions

Through systematic teaching practice, students have made significant progress in three dimensions: knowledge, ability, and values. At the knowledge level, students have not only mastered the core concepts and operational skills required by the General Technology curriculum but also gained a systematic understanding of the development context of traditional Chinese technology. Through thematic learning on “the history of technological development,” students can sort out the historical inheritance context from *Kaogong Ji* to modern industrial technology and understand the inherent laws of technological development. At the ability level, students’ innovative thinking, engineering practice, and problem-solving abilities have been significantly improved through project-based learning and practical activities ^[14]. Particularly in the “traditional craft innovation design” project, students combined traditional craftsmanship with modern design concepts to create innovative works. At the value level, teaching designs integrated with characteristic content, such as border area construction history and traditional crafts, have effectively stimulated students’ cultural identity and feelings for the country. Through the analysis of “the Belt and Road” technology exchange cases, students have deeply understood the important role of technological development in promoting national unity, and the awareness of mutual understanding and unity and cooperation among students of different ethnic groups has been significantly enhanced.

In terms of teaching reflection and improvement, through various evaluation methods such as classroom observation, student questionnaires, and work analysis, it is found that some teaching links still have room for optimization. First, in content design, it is necessary to further enrich historical background materials, especially by adding typical cases such as border area development and traditional craft protection. Vivid cases such as technological exchanges on the “Ancient Tea Horse Road” and craft dissemination on the “Silk Road” can be supplemented to make the combination of technology learning and cultural inheritance closer. Second, in teaching methods, more interactive team cooperation projects can be developed. For example, designing an “ethnic craft innovation workshop” to allow students to experience the creative process of craftsmen from different ethnic groups through role-playing and scenario simulation, to deepen their understanding of the relationship between

technological development and social progress. Finally, in the evaluation system, more diversified evaluation standards will be established, focusing not only on the functionality of technical achievements but also on the cultural connotation of works, as well as team cooperation and cultural understanding in the creation process. In the future, we will also explore in-depth cooperation with communities, museums, and other institutions to carry out practical learning activities such as “intangible cultural heritage skill inheritance” and “ethnic craft innovation,” invite folk artists to campus, and organize students to conduct field trips to local cultural centers, to build a more complete teaching system for cultivating new-era talents with cultural confidence, innovative spirit, and social responsibility^[15]. At the same time, it is planned to develop a digital teaching resource database, integrating video materials of various ethnic characteristic crafts to provide students with richer learning materials.

6. Conclusion

Against the backdrop of the comprehensive education of curriculum-based ideological and political education, integrating the forging of a strong sense of community for the Chinese nation into high school General Technology teaching is an inevitable requirement for ideological and political education work in the new era, and holds important practical significance and value. By inheriting the local characteristic red culture, adopting effective teaching strategies, improving students’ technical literacy, cultivating their cultural literacy, strengthening their sense of social responsibility, and enhancing their national identity and pride, we can contribute to nurturing new-era talents with an innovative spirit and practical ability.

Disclosure statement

The author declares no conflict of interest.

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Teaching Quantum Mechanics Content in General Physics based on Online Courses

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Abstract: As one of the fundamental theories of physics, quantum mechanics is a major fusion of classical and modern physics and has great potential for development. With the continuous reform of higher education in China, the curriculum structure of engineering students has also changed. The phenomenon that classical physics occupies too high a proportion in traditional physics teaching is more prominent, and quantum physics occupies a lower proportion in physics teaching. This paper discusses how to strengthen and deepen the content of quantum physics in general physics teaching, based on online courses, to overcome the difficulties of insufficient credit hours and to build a good infrastructure for training quantum science and technology talents.

Keywords: Online-course; Quantum mechanics; Teaching strategies

Online publication: October 17, 2025

1. Teaching difficulties in quantum mechanics content in general physics

Quantum mechanics is a fundamental theory that studies matter, energy, particles, and the interactions and laws between them. It involves a series of basic concepts in physics such as the “microscopic world,” “material composition,” and “energy phenomena,” and its applications are quite extensive. The development of medical imaging, nanoscience, laser physics, and the semiconductor field is all based on quantum principles. Quantum information technology (quantum computers, quantum encryption, and quantum entanglement) is a current hotspot. The content of quantum mechanics has always been an important part of university general physics teaching. Teachers should analyze and compare the importance of quantum physics from a professional perspective, help students understand the connections and differences between quantum physics and classical physics, and enhance students’ awareness of quantum mechanics and its significance for the development of other disciplines. However, due to various reasons, the quantum mechanics section faces great difficulties in general physics teaching.

Firstly, it is determined by the characteristics of quantum mechanics itself. The way quantum mechanics understands the physical world and perceives physical reality is fundamentally different from classical physics, with a radical change ^[1]. This requires us to abandon the classical physical images formed over a long period

and adopt new concepts of quantum mechanics to understand experimental results and explain experimental phenomena, causing various difficulties in teaching and learning ^[2].

Secondly, the study of quantum mechanics requires the use of a lot of mathematical knowledge, such as partial differential equations, complex functions, and linear algebra, which most students have not mastered proficiently, further increasing the difficulty of teaching and learning. Combined, these two reasons result in the fact that in current university general physics textbooks, the proportion of quantum mechanics content is not high, tends to be introductory, and avoids content with difficult and complicated calculations ^[3]. The last important difficulty is the insufficient teaching hours. In 1999, Mr. Zhao Kaihua called for setting the number of physics hours in engineering colleges to no less than 300 ^[4]. Now, the number of physics hours in general colleges and universities is around 100, and some have less than 80. The teaching content has been repeatedly reduced, and the proportion of quantum mechanics is extremely small. The limited classroom teaching time makes it difficult to explain the inherently difficult concepts and theories clearly, basically reducing it to an introduction to the history of quantum mechanics or popular science of quantum mechanics. Moreover, a considerable number of colleges and universities do not specifically offer quantum mechanics in related professional courses that require basic knowledge of quantum mechanics, such as optoelectronics, materials, and semiconductor technology. Relying solely on the “introduction” to quantum mechanics in general physics, it is hard to imagine how students can truly understand the relevant content and learn the corresponding professional courses well.

Of course, we do not hope to introduce the content of physics majors in general physics teaching, nor do we expect students to master complicated calculations (although there is a widely circulated saying that one cannot understand quantum mechanics without calculation - “shut up and calculate”). However, it is still possible to clarify the basic concepts and theoretical framework of quantum mechanics based on an “introduction” ^[5].

2. Teaching based on the SPOC model

To address issues in quantum mechanics teaching, such as “insufficient course hours”, “weak mathematical foundation,” and “low student interest leading to poor results,” the Internet has brought new opportunities for the development of traditional education. In the teaching of quantum mechanics-related content in general physics, we can fully leverage the advantages of the Internet to improve classroom teaching efficiency and effectiveness, and promote teaching reform and innovation through effective means. The reform of teaching quantum mechanics content in general physics courses based on the SPOC model combined with the PBL (Problem-Based Learning) teaching model is a promising approach worth exploring.

SPOC refers to a blended teaching model that combines online and offline learning. It integrates online resources from in-school teachers with classroom teaching. Through online teaching videos, reference materials, online assignments, quizzes, and other teaching resources, students first learn independently online. Then, they engage in face-to-face discussions, question-and-answer sessions, experiments, etc., in the classroom. Finally, offline assessments are conducted to complete the teaching process. PBL, on the other hand, is a student-centered learning model. With the assistance of teachers, students plan, implement, and self-evaluate their learning. Teachers allow students to select a research topic based on their interests and abilities, then collect information, explore, and discuss the topic.

In combination with the content of quantum mechanics courses, knowledge units are decomposed, and short teaching videos (5–15 minutes) are recorded. The video content should cover basic knowledge points, basic concepts, basic principles of the course, especially those contents that require more time in class, such as

introduction to mathematical foundations, theoretical derivations, and explanation of exercises. Providing these through online mode helps to streamline classroom teaching time and allows students to watch repeatedly for better absorption and understanding. Teaching syllabuses, lecture notes, practice questions, reference materials, and resource libraries are provided as support for the course. The establishment of quantum mechanics concepts can be explained from the perspective of the history of science to help students understand ^[6]. In the past, due to time constraints, it was difficult to introduce the basic concepts of quantum mechanics and the context of theoretical development in detail. Now, popular science articles and literature can be provided online for interested students to read. Directly presenting a concept or theory to students is completely different from guiding them to observe and appreciate how physics masters established and completed their work in the long river of history in terms of the aesthetic experience. It is like crossing the Qinling Mountains: taking a tunnel is certainly fast, but climbing the winding mountain roads allows you to enjoy more magnificent scenery. In addition, there are many corresponding achievements in the visualization research of quantum mechanics ^[7]. Games developed to help understand quantum theories can provide relevant resources or access links in online courses to help students establish physical images and understand related content.

SPOC requires students to first conduct online autonomous learning, and the premise of guiding and motivating students to learn online is to give them a problem or project to complete. The problems and projects need to be carefully designed, considering dimensions such as stimulating students' interests, covering corresponding knowledge points of the course, the difficulty of the problems, and being close to applications and cutting-edge developments. Through collecting and reading materials, watching and thinking about course knowledge point videos, students return to offline classroom teaching to communicate and share with classmates and teachers about the questions and gains in online learning, so as to truly understand and master the course content.

3. Teaching examples

Laser technology is one of the most significant scientific achievements of the 20th century. In traditional general physics textbooks, the quantum mechanics section usually covers the principles of lasers. However, due to time constraints in actual teaching, the content often has to be abbreviated, resulting in only brief introductory explanations or being assigned as reading materials for students. In Mr. Zhao Kaihua's works, the physical basis of laser technology is given a prominent position. We have attempted to use online courses to provide a brief introduction to the quantum mechanical principles of lasers without increasing classroom hours, and to guide students in understanding relevant cutting-edge developments ^[8].

As shown in **Figure 1**, this course design consists of two parts: approximately 40 minutes of online learning and 45 minutes of offline learning. The first dashed box represents the online learning section. After studying the content related to Bohr's hydrogen atom energy level structure, students are guided to think about the developments and applications brought about by energy level theory. Corresponding materials are provided online for students to read and reflect on, such as a brief introduction to the development history of lasers (from Einstein's proposal of laser theory to the actual realization of lasers), China's contributions to laser technology, and the development of modern laser technology and its applications in industrial production. Two short teaching videos on spontaneous emission, stimulated emission, and the basic principles of lasers are produced for students to learn basic concepts and theories.

In classroom teaching, on the premise that students have mastered the basic knowledge, they are divided into groups to present their answers to the guiding questions and engage in mutual "defense." Then, possible

Question: What developments and applications have emerged from the understanding of the (hydrogen atom) energy level structure?	Absorption spectrum (technical principle, dark lines are not completely “black”)	Raman spectral analysis and its applications (chemistry, biology, semiconductor)
Energy level transition Absorbing photons Emitting photons (search for and read relevant materials)	Emission spectrum Spectral analysis (visible light – electromagnetic wave) Substance analysis – discovery of isotopes	Calculation, hypothesis, first - principles
Ground state of atom – two ways to excited state Electron collision (neon lamp) Photon absorption (Video explanation: 8 minutes)	Comparison with Compton effect. In the Compton effect, photons can only lose part of their energy. For stimulated emission, the incident photons must have a certain amount of energy.	Not all energy level transitions will emit light – selection rule Material selection for LED, solar cell Cell efficiency (10-20%), maximum 47% in laboratory. The efficiency of plant photosynthesis is close to 100% ---explanation by quantum mechanics---application prospects
Laser: Light amplification caused by stimulated emission. Features: Monochromatic, coherent General excited state: 10^{-8} s Metastable excited state: 10^{-3} s Ground state Population inversion Three - level: Ruby Four - level: Helium - neon Animation demonstration of three - level and four - level excitation (Video explanation: 15 minutes) Online Learning Part	Why can't two - level be realized? How to create a metastable state? (Doping Cr^{3+} (trivalent chromium ion) in ruby) Comparison of the difficulty in achieving population inversion between four - level and three - level.	Expanded Knowledge, Sci - Tech Frontiers
In - class Discussion Part		

Figure 1. Course design for “Laser” content based on the SPOC model.

problems raised by students are addressed. Common typical questions include: What is the difference between a gas luminescence system and a laser? Why can a second-order system not produce a laser? How to achieve and understand population inversion? ^[9] These questions may be answered by the students themselves or may require the teacher to explain using semiclassical theory to help students form a complete physical picture. Finally, the focus is on discussing the related content of spectral analysis and laser principles. Striving to provide qualitative explanations without involving complex calculations, the aim is to enable students to understand and master their development history and related principles, as well as their applications in modern research and industry. Extended relevant content can also be provided for students with extra capacity to explore, playing a forward-looking role for students of different majors in their future professional course studies. For example, an approximate calculation used in the discovery of isotopes: the problem of electron motion can take the nuclear coordinates as the reference frame (approximately considering the nucleus as almost stationary), which is actually the Born-Oppenheimer adiabatic approximation in the development of first-principles, and first-principles play an important role in modern materials science and condensed matter physics research. Another example is that in third-order and fourth-order models, after achieving population inversion, it is found that the transition between two certain energy levels does not “emit light.” This involves selection rules and requires more basic knowledge of quantum mechanics (such as concepts like quantum numbers) and calculations. In practical applications of materials science, this relates to the selection of materials for LEDs and solar cells. Furthermore, a comparison can be made between the efficiency of solar cells and that of plant photosynthesis, and the high efficiency of plant photosynthesis can also be explained using quantum mechanics, which in turn can help us design high-efficiency solar cells ^[10].

Combining question guidance with mixed online and offline teaching, the detailed introduction to historical development, basic principles, and application frontiers can basically enable students to master the basic concepts, theories, and methods of this content. It also allows them to understand specific applications in scientific research

experiments and industrial production, which would be difficult to achieve in traditional classroom teaching, where it is hard to convey such rich content within a limited time while guiding students to think about related issues^[11,12]. The advantage of the SPOC model lies in awakening students' problem awareness, guiding them to engage in research-based learning, and improving their ability to analyze and solve problems.

4. Assessment and evaluation

Students will be given a comprehensive score based on their submitted assignments and performance in classroom teaching activities. The method of classroom questioning can enable students to conduct in-depth discussions around a certain knowledge point. In group discussions, students can improve their understanding and mastery of classroom knowledge through discussions, and it can also increase communication between teachers and students. At the same time, grouping students for discussions allows for better division of labor and cooperation, cultivating the ability of unity and collaboration among group members. During group discussions, teachers should keep track of students' mastery of the knowledge point at all times to make timely adjustments and improvements.

By monitoring and analyzing the teaching process of teachers, we can understand students' learning situation of the core content and other contents of the course. Through discussions and exchanges with students, we can learn about students' problems and difficulties in the course learning process, their ability to solve problems, and their learning interests. Evaluation is carried out according to the knowledge points and key points included in the course design. The key contents include whether the course concepts are clear; whether the course theories are solid; whether the classroom participation meets expectations; and whether students have the basic ability to solve practical problems^[13]. For classes with low participation rates (below 50%) and some classes with relatively low participation rates (above 30%), targeted teaching reflections should be conducted.

5. Achievements and reflections

In the actual teaching process, the author compared two teaching classes, one adopting the SPOC model and the other adopting the traditional classroom teaching model. Although there was little difference in the written test scores in the final assessment, in the class taught by the SPOC model, students' classroom participation was significantly higher, the classroom atmosphere was active, and their interest in physics class was significantly higher than that in the traditional classroom teaching class. Students had a deeper understanding of some contents of quantum mechanics, laying a solid foundation for their further study in related fields^[14,15].

Of course, the SPOC model requires the active participation of students. It can be found through the records of the course platform that not all questions can get positive responses from students, and not all students can actively participate in online course learning. On the one hand, teachers need to carefully design questions and projects to improve participation interest and reduce participation thresholds; on the other hand, it is also necessary to convey the importance and necessity of research-based learning to students in teaching. To sum up, it is feasible and beneficial to strengthen and deepen the teaching of quantum mechanics content in general physics teaching by using online courses.

Funding

School-level teaching research project of Wuhan University of Science and Technology, "Realizing Hierarchical Teaching of College Physics Based on Online Courses" (Project No.: 2020X049)

Disclosure statement

The authors declare no conflict of interest.

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Exploration on the Path of Deep Integration of Intelligent Technology and Campus Culture

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Abstract: This paper conducts an in-depth discussion on smart campuses, systematically expounds their definitions and characteristics, analyzes the paths and impacts of integrating technology with campus culture, explores the transformative role of smart campuses in campus life, and examines the challenges they face. It aims to reveal the development laws and value of smart campuses in the field of education, providing theoretical references and practical insights for promoting the healthy and sustainable development of smart campuses.

Keywords: Intelligent technology; Campus culture; Deep integration; Path exploration

Online publication: October 17, 2025

1. Introduction

The new technological revolution and the Internet revolution are exerting extensive and far-reaching impacts on global education. With the growing popularity of artificial intelligence (AI), an information-driven lifestyle has gradually permeated every aspect of our lives. As hubs for knowledge exchange in education and teaching, as well as centers for talent cultivation, university campuses are inevitably stepping into the AI era alongside the tide of the times ^[1]. The construction of AI-powered campuses is not a simple process of technological superimposition, nor a mere confrontation or conflict between technology and culture. Instead, it is a process where technology serves and drives education, and scientifically reshapes campus culture. From the perspective of how smart campuses transform campus life and further influence the evolution of campus culture, conducting in-depth observation, analysis, and reflection on the changes in university campus life and the impacts on campus culture will provide certain guiding significance for the transformation and innovation of future education ^[2].

2. Innovations brought by intelligent technology to campus culture

2.1. Reshaping the dissemination channels of campus culture

Traditional ways of disseminating campus culture mainly rely on campus radio, notice boards, school newspapers, and publicity columns, which have limited reach, slow information updates, and a lack of interactive

functions. The emergence of intelligent technology has completely changed this situation. Social media and smart terminals have become carriers for spreading campus culture. Schools can instantly publish content such as campus cultural activities, academic salons, and the achievements of teachers and students on WeChat Official Accounts, Weibo, and short-video platforms. Additionally, the application of intelligent voice assistants and intelligent recommendation algorithms enables targeted delivery of cultural information, making the dissemination more precise^[3].

2.2. Enriching the presentation of campus cultural content

Artificial intelligence has opened up new possibilities for presenting campus cultural content^[4]. Virtual school history museums built with VR technology allow visitors to immerse themselves in the school's history. Through 3D models, panoramic displays, and the restoration of historical scenes, major events and stories of important figures in the school's history are presented more intuitively, deepening students' understanding of the school's historical culture. AR technology, which adds virtualized information to real-world scenarios, can make campus cultural content more engaging. For example, during campus cultural activities held on traditional festivals, AR-based activities can be organized to enhance fun; or AR can be used in historical sites to display background information related to those sites, helping students gain a deeper understanding of historical contexts and real-life situations. In short, AI applications in creating poetry, paintings, and music provide new directions for presenting campus cultural content and inspire new ideas for teachers and students in cultural creation.

2.3. Promoting innovation in campus cultural activities

The innovation of campus cultural activity forms is inseparable from intelligent technology. A single mode of participation has long been a problem for students in traditional campus cultural activities, but the application of intelligent technology can expand the participation forms of traditional activities^[5]. Firstly, AI technology analyzes students' information and behavioral data to form data portraits based on their interests and hobbies, enabling precise activity recommendations to boost students' enthusiasm for participation. Secondly, intelligent technology can facilitate innovation in activity formats, such as combining online and offline cultural events, or experiential activities based on virtual reality technology. For instance, in online poetry contests held by universities, students participate in quizzes via mobile phones or computers. The system counts students' participation in activities in real time and ranks those who have answered more questions correctly. This not only enhances the fun of the activities but also encourages more students to participate^[6].

3. Challenges in the in-depth integration of intelligent technology and campus culture

3.1. Difficulties in matching technology with educational goals

With the development of intelligent technology, its application scenarios have been continuously expanding. However, in the process of campus culture construction using intelligent technology, there is a phenomenon where technology does not align with the educational goals of teaching and learning. Some schools pursue advanced technology and blindly introduce intelligent devices and systems without matching them with relevant activity contents based on the purpose of technology, leading to a separation of technology from educational and teaching practices^[7].

3.2. Dilemma of uneven distribution of educational resources

The popularization and application of artificial intelligence require certain support in terms of hardware, networks, and talent, which has widened the gap in educational resources between regions and schools. Economically developed regions and first-class universities have relatively superior educational resources, enabling them to invest heavily in developing intelligent campuses, providing various advanced intelligent hardware devices, and organizing rich intelligent campus cultural activities. In contrast, economically underdeveloped areas and ordinary schools, due to insufficient economic conditions, lack intelligent hardware equipment and have poor network conditions, making it difficult to carry out the practice of intelligent campus culture. This results in an imbalance in the distribution of educational resources, which is not conducive to the in-depth integration of artificial intelligence and campus culture, nor to the shared access of intelligent campus culture by all, further exacerbating educational inequity.

3.3. Difficulties in teachers' adaptation to role transformation

In the in-depth integration of intelligent technology and campus culture construction, teachers are transforming their roles from traditional knowledge transmitters to learning assistants, which places higher demands on them. On one hand, at present, some teachers have a low level of mastery of intelligent technology, lack relevant training and practical experience, and thus cannot organically integrate intelligent technology into teaching for campus culture construction. On the other hand, teachers need to change their educational concepts and adapt to teaching models in an intelligent teaching environment. With the support of intelligent technology, students have diversified channels to acquire knowledge, so teachers must pay more attention to cultivating students' abilities such as independent learning and innovation, which puts forward higher requirements for their teaching methods and instructional design ^[8].

4. Specific paths for the in-depth integration of intelligent technology and campus culture

4.1. Building an intelligent campus culture platform

The construction of an intelligent campus culture platform requires a multi-dimensional approach, creating a comprehensive digital carrier that integrates resource integration, intelligent services, and interactive communication.

In terms of resource integration, the platform should not only include all cultural resources, such as school history materials, publications, and artistic works by teachers and students, but also utilize cloud computing for large-scale data storage and management. Additionally, it should apply natural language processing technology to tag resources by category, making it easier for teachers and students to search. For example, students can quickly access videos of the school's cultural activities in recent years or the academic research achievements of distinguished alumni by entering keywords ^[9].

Intelligent services on the platform are driven by big data analysis technology and artificial intelligence algorithms. The platform collects data on teachers' and students' academic and daily lives, analyzes their interests and behavioral habits, and pushes personalized campus cultural services. For instance, it can send information about on-campus reading clubs or author lectures to students interested in literature, and notify teachers and students with a passion for technology about lab openings or technology competitions. Furthermore, the platform can feature an AI customer service that uses semantic recognition technology to instantly respond to queries

related to cultural activities and resources.

The interactive communication section aims to break the bottleneck of one-way campus culture dissemination, fostering a cultural ecosystem where teachers and students co-construct, share, and evaluate content. Teachers and students can post cultural and creative works, establish online cultural discussion clubs, and like, comment on, or forward such works. Meanwhile, the platform integrates VR and AR technologies to build a virtual cultural community, allowing teachers and students to participate in cultural exhibitions, salons, and other events online through avatars. This enhances the sense of presence and interactivity in cultural experiences, further boosting the vitality and cohesion of campus culture ^[10].

4.2. Launching intelligent campus cultural activities

To develop intelligent campus cultural activities, it is necessary to make good use of technologies such as VR (Virtual Reality), AR (Augmented Reality), and AI (Artificial Intelligence) to enrich students' immersive and diversified forms of campus cultural activities. With VR technology, major events in the campus history or representative scenes of various historical periods can be made into an immersive “cloud campus history tour” cultural activity for students. With the help of 3D modeling and scene restoration technologies, students can watch the changes of school history as if they were there and feel the pulse of history. In addition, world-famous painting exhibitions can be introduced into the campus. Through VR high-definition three-dimensional display technology, world-famous art and cultural resources can be opened for free, breaking the limitations of time and space, allowing students to improve their appreciation level through the most realistic observation ^[11].

AR technology can also be applied to campus cultural festivals. According to different forms of campus cultural festivals, AR task points can be set in different locations, such as teaching buildings and playgrounds. During the activities, students can click on the AR icon on their mobile phones to watch AR videos related to the theme of the campus cultural festival, such as animations, poems, and historical cultures. Or they can click and scan the corresponding cultural AR landmarks to watch cultural videos. After completing the tasks, certain points will be given, which can be used to exchange for cultural souvenirs, thus stimulating students' enthusiasm for participation.

Based on students' interests and activity time, the school uses AI algorithms to compare and screen, and actively pushes personalized campus activity plans to students. For example, students who like music are recommended to participate in campus singer competitions and music appreciation activities. Relying on AI image recognition and speech recognition, online creative design activities such as “I Love My Home” and poetry recitation competitions can be carried out, and automatic evaluation and intelligent comment work of entries can be completed, making the activities more efficient and professional, and endowing campus cultural activities with the characteristics of the times and charm.

4.3. Strengthen the integration of intelligent technology and humanistic education

From the perspective of curriculum development, schools can incorporate interdisciplinary knowledge such as artificial intelligence ethics, digital culture, and art into their curriculum design. This will guide students to consciously reflect on and address ethical issues arising from intelligent technology, as well as the lack of a humanistic spirit. For example, when students encounter traffic accidents involving autonomous driving, they can rethink the problems in artificial intelligence: What choices did AI make? What path did it take? A notable example is understanding and grasping the art and technology of AI. Through digital art courses, for instance, students can use artificial intelligence to create paintings, music, and other works, while pondering

the connotations and emotional experiences carried by these technology-created artworks. In daily teaching of humanistic education, intelligent technology can enrich the forms of humanistic education. For example, virtual reality technology can be used to recreate historical scenes, allowing students to “immerse” themselves in ancient historical and cultural contexts, deepening their perception and understanding of ancient history and culture. Intelligent learning analysis technology can be used to mine students’ learning trajectories, providing data references for teachers’ personalized humanistic education. For instance, different students have different reading interests, and teachers can recommend ancient classic literature that interests them, supplemented by AI intelligent guidance to help students better understand the text content.

In campus cultural activities, events themed “AI + Traditional Culture” can be organized. For example, AI ancient poetry creation competitions based on natural language processing technology can be held. Students use artificial intelligence to generate ancient poems, and teachers then interpret the humanistic value and cultural connotations, which not only stimulates students’ enthusiasm for learning traditional culture but also allows them to experience the value creation brought by the application of artificial intelligence. Additionally, activities such as moral councils and digital civilization exhibitions featuring new artificial intelligence technologies can be carried out to help students establish correct values and views on nature ^[12].

4.4. Enhance teachers’ ability to apply intelligent technology

The development of teachers’ ability to apply intelligent technology is a comprehensive, hierarchical, and gradient training process. Firstly, design training strategies at the top level and create a classified training model. Different training contents should be designed according to disciplinary characteristics and teachers’ teaching age stages, and new teachers can be stratified and classified by experienced backbone teachers ^[13]. For new teachers, training can focus on the preliminary use and basic application of intelligent teaching-related hardware and software. For experienced backbone teachers, in-depth studies can be organized, including artificial intelligence-assisted teaching, enabling them to design artificial intelligence-assisted teaching based on specific problems and help them develop suitable teaching models using these intelligent technical means. In terms of training methods, a combination of “online + offline” approaches can be adopted. Online MOOC courses can be the mainstay, fully considering their autonomy and flexibility, and providing teachers with opportunities and time for self-study. Offline methods such as centralized training and workshops can be used, with “famous teachers” and “experts” invited to guide offline training and workshops, helping teachers share excellent experiences and exchange ideas to improve their ability to apply intelligent technology ^[14].

Secondly, design incentive systems to form an effective learning incentive mechanism, stimulating teachers’ motivation to improve their ability to apply intelligent technology through application mechanisms. For example, “incorporating teachers’ intelligent technology application level into the teacher title evaluation system” and “school annual performance evaluation system” can be set up, and preferential treatment can be given in title evaluation and performance assessment to teachers who perform well in intelligent technology teaching and intelligent construction of campus culture ^[15]. In addition, combined with teachers’ teaching age, schools can establish special funds for teachers’ intelligent technology teaching innovation, encouraging teachers to actively engage in teaching reform practice and exploration. Schools can learn from teachers’ cases of in-depth integration of intelligent technology and teaching, such as how to deeply integrate intelligent technology with campus culture and how to create intelligent scenarios to improve teaching innovation. Teachers with outstanding innovative practices should be promoted, and a good atmosphere should be formed for building new education models and sharing teacher resources.

5. Conclusion

The in-depth integration of intelligent technologies and campus culture is not only a requirement of the times but also an inevitable need to deepen the construction of campus culture and promote the all-round development of students' qualities. At the same time, it inevitably faces problems in aspects such as technical matching, resource allocation, and the transformation of teachers' roles during the in-depth integration process. Based on this, under the guidance of the overall thinking, approaches such as building an intelligent campus culture platform, implementing intelligent campus cultural activities, strengthening the integration of intelligent technologies and humanistic education, enhancing teachers' training in the application of intelligent technologies, and improving the guarantee of educational policies and regulations have laid down specific and referential paths for advancing the in-depth integration of intelligent technologies and campus culture.

Funding

ZUST Special Program for Party Building and Ideological and Political Work (Project No.: 2025SZZD005)

Disclosure statement

The authors declare no conflict of interest.

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A Study on the Teaching of Mathematical Methods for Physics based on the Laws of Scientific Cognition: The Introduction of Complex Numbers as an Example

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Abstract: The development of innovative talent should be guided by the principles of scientific cognition. Currently, there is a significant gap in students' understanding of the origin, visualization, and necessity of complex numbers, particularly in their application to physics. This paper examines the historical development of complex numbers, tracing contributions from Ferro, Cardano, and Bombelli to Gauss's systematic geometric representation. It emphasizes the necessity and geometric significance of introducing complex numbers. Additionally, the paper explores the critical role of complex numbers in physics, especially in quantum mechanics. Using the Schrödinger equation as a case study, we demonstrate that the introduction of complex numbers not only ensures the existence of solutions but also provides a natural framework for describing the phase evolution and probability amplitudes of wave functions for microscopic particles. Through a thorough analysis of the motivations for the introduction and application of complex numbers, this paper aims to enhance students' understanding of their mathematical nature, geometric visualization, and physical significance, ultimately contributing to the development of innovative talent.

Keywords: Complex numbers; Visualization of complex numbers; Schrödinger equation; Scientific cognition principles

Online publication: October 21, 2025

1. Introduction

The section on complex function theory in Mathematical Methods for Physics is often regarded as one of the most elegant mathematical developments of the 19th century^[1], with its first section focusing on complex numbers. However, the author observes that most textbooks on mathematical physics methods typically introduce the concept of complex numbers and their operations directly, with few addressing the historical context or the necessity of introducing complex numbers. While college students generally encounter complex numbers in high school, learning to perform basic operations such as addition, subtraction, multiplication, and division, the author

notes that many students lack a deeper understanding of why complex numbers were introduced, how they are visualized, and their necessity in physics. Furthermore, some students perceive complex numbers as abstract constructs invented by mathematicians, failing to recognize their real existence. Many are also unaware that the introduction of complex numbers was not to make quadratic equations solvable, but rather that the root formula for quadratic equations led to the need for complex numbers.

The cultivation of innovative talent must be grounded in the principles of scientific cognition. Drawing on teaching experience, the author applies the law of scientific cognition to explain the introduction of complex numbers, addressing how the solution to is derived and demonstrating the historical and physical necessity of complex numbers ^[2]. This approach aims to help students recognize that complex numbers are indeed real numbers, that the solution to is valid, and that complex numbers are essential in physics. By doing so, students will gain a deeper understanding of the scientific inquiry process.

In the early days of mathematics, solving quadratic equations was problematic, as negative numbers had not yet been introduced. For example, equations like, were unsolvable, and the concept of negative values was not easily understood. However, as new concepts such as debt and temperature emerged, negative numbers gradually gained acceptance ^[3]. Humans have long known the root formula for quadratic equations, and it has been demonstrated that the Babylonians were proficient at solving quadratic equations ^[4]. However, for the equation , the root formula produces , and people at the time could not comprehend the notion of negative values under the square root. Consequently, they concluded that no solution existed for this equation. Graphically, the function does not intersect the x-axis, making the absence of solutions intuitive.



Figure 1. Historical figures associated with the formula for finding the roots of a cubic equation in one degree.

The situation changed drastically when mathematicians turned to solving cubic equations (**Figure 1**). Unlike in ancient Babylon, where quadratic equations were solved over 4,000 years ago, it was not until around 1500 that Scipione del Ferro (1465–1526) of the University of Bologna discovered a method for solving cubic equations. Ferro discovered the method for deriving the formula to find the roots of a cubic equation, but kept his solution secret until his death, never revealing the formula publicly. The primary reason for this secrecy stemmed from the intellectual climate of his time. Unlike today’s universities or research institutions, which derive academic prestige from the publication of scholarly papers, individuals in the Renaissance period earned their reputations through public problem-solving contests, often gaining recognition by challenging one another

in public duels of intellect.

Before his death, Ferro passed the formula for solving quadratic equations to his pupil Fior and his son-in-law, Nave. In 1535, the ambitious and impetuous Fior approached Tartaglia, one of the most prominent mathematicians of the era, seeking a mathematical duel. However, Tartaglia had already solved the quadratic equation problem, leaving Fior's challenge unsuccessful. It was in this same year that Fior, unaware of Tartaglia's solution to the cubic equation, requested a duel over the cubic problem. To his surprise, Tartaglia had also derived a solution for the cubic equation. Later, Cardano, a mathematician of note, sought Tartaglia's formula for solving cubic equations and persuaded him to share it under the condition of secrecy. However, by chance, Cardano discovered that Ferro's formula was identical to Tartaglia's during a visit to Ferro's son-in-law, Nave. Realizing that the secret no longer needed to be kept, Cardano published the formula for finding the roots of a cubic equation in his influential work *Ars Magna* (1545). The root of a cubic equation (1) can be solved using the formula (2) [5]:

$$x^3 + cx = d \quad (1)$$

$$x = \sqrt[3]{\frac{d}{2} + \sqrt{\frac{d^2}{4} + \frac{c^3}{27}}} + \sqrt[3]{\frac{d}{2} - \sqrt{\frac{d^2}{4} + \frac{c^3}{27}}} \quad (2)$$

This rooting formula is much more complicated than the rooting formula for quadratic equations and can solve some of the quadratic equations, but for the equation $x^3 - 15x = 4$, the solution using the rooting formula is:

$$x = \sqrt[3]{2 + \sqrt{-121}} + \sqrt[3]{2 - \sqrt{-121}} \quad (3)$$

The result will have $\sqrt{-121}$ in it, and according to conventional wisdom, once there is a negative number under the root sign, the equation is unsolvable.

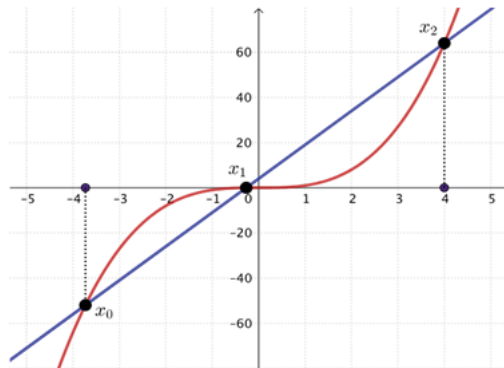


Figure 2. Image of the function of x^3 and $15x + 4$.

However, if we approach it from a different perspective and move to the right-hand side of the equation, we then have two equations: $y = x^3$ and $y = 15x + 4$ as shown in **Figure 2**. Since x^3 grows faster than the linear function, it is evident that, for $x > 0$, these two functions must intersect at some point within this range. By using a trial-and-error method, we can determine that $x = 4$ is a solution. Initially, applying the root formula suggested there was no solution, but through this alternative approach, we arrive at a valid solution. This creates a contradiction, which, as the history of science has repeatedly shown, often signals a breakthrough—

contradictions are frequently where scientific progress is made.

To resolve this issue, Bombelli introduced the symbol $\sqrt{-1}$ in 1572 ^[6], and we define:

$$\sqrt[3]{2 + \sqrt{-121}} = a + b\sqrt{-1} \quad (4)$$

$$\sqrt[3]{2 - \sqrt{-121}} = a - b\sqrt{-1} \quad (5)$$

Taking the cube of both sides and simplifying, we obtain:

$$2 = a(a^2 - 3b^2) \quad (6)$$

$$11 = b(3a^2 - b^2) \quad (7)$$

Solving equations (6) and (7) gives $a = 2$ and $b = -1$. Therefore,

$$x = 2 + \sqrt{-1} + 2 - \sqrt{-1} \quad (8)$$

The two $\sqrt{-1}$ in the result cancel out exactly, leading to the solution $x = 4$ ^[7], which is an exciting result because one can actually calculate $x = 4$ from a bunch of complicated equations, and although Bombelli himself considers it a sophistry, his method can inspire others.

Later, Descartes coined the term “imaginary number” for expressions like $\sqrt{-1}$ ^[8,9], which translates as “虚数” in Chinese, reflecting the prevailing view among the most prominent mathematicians of the time that complex numbers were not considered “real” numbers. In 1777, Euler adopted the letter “i” from the word “imaginary” to represent $\sqrt{-1}$ ^[10]. Despite being one of the most brilliant mathematicians of his era, Euler’s understanding of complex numbers was not entirely complete. This is evident from his work, where we find the following equation:

$$\sqrt{-2} \times \sqrt{-3} = \sqrt{6} \quad (9)$$

Obviously, this is wrong, it is known that the correct result for $\sqrt{-2} \times \sqrt{-3}$ is $-\sqrt{6}$, but Euler got the correct Euler’s formula ^[11] without being clear about the geometrical meaning of imaginary units.

It was not until later, in 1797, that the Norwegian surveyor Caspar Wessel and the French mathematician Argand (in 1806) first proposed representing complex numbers using a geometric plane, which we now refer to as the complex plane ^[12]. The complex plane consists of a real axis and an imaginary axis perpendicular to it. It is important to note that this plane is not simply a repetition of the Cartesian coordinate system. As we know, $i^2 = -1$, which leads to the following:

$$1 \times i \times i = -1 \quad (10)$$

This implies that 1 becomes -1 after two multiplications by i , indicating that each multiplication by i corresponds to a 90° rotation, as illustrated in **Figure 3**. Therefore, the geometric interpretation of i is that the imaginary unit i is positioned one unit away from the origin along the imaginary axis. Any number multiplied by i represents a 90° rotation. The imaginary number is essentially a real number, but it exists on a line perpendicular to the real axis, in a different dimension. This provides a natural foundation for the concept of the complex plane, as shown in **Figure 4**.

The concept here suggests that complex numbers are, in fact, real numbers, but with dimensions. A complex

number can be considered a two-dimensional number, with its second dimension lying along a direction perpendicular to the familiar real axis. It is essential to think of a complex number as an extension of real numbers. In fact, numbers exist not only in two dimensions but also in higher dimensions, such as four, eight, sixteen, and beyond. However, for the purposes of physics, the domain of complex numbers is sufficiently expansive. With a clear understanding of the geometric significance of the imaginary unit, the development of complex numbers took a more structured path. This was further advanced through the work of mathematicians such as Gauss, Cauchy, and Riemann, eventually leading to the modern theory of functions of a complex variable. It took 250 years from the discovery of the cubic root formula to the explanation of the complex plane. During this period, the understanding of complex numbers evolved in a spiral, progressing in a complex and winding manner. As Marx once said, there are no smooth highways in science; only those who are undaunted by hardship and climb the steep mountain paths can reach the brilliant summit.

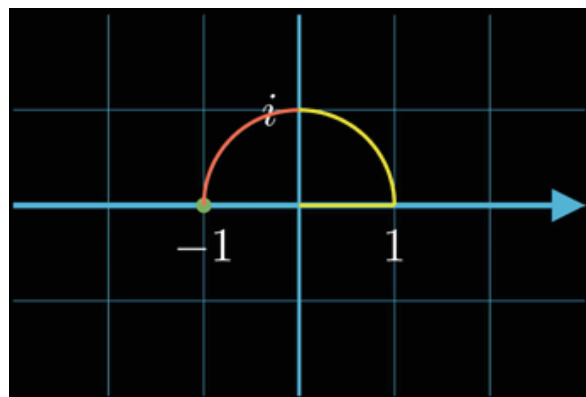


Figure 3. Geometric meaning and representation of imaginary numbers.

The visualization of complex numbers presents a more challenging task. For the function $f(z) = z^2 + 1$, both the independent variable and the function value are complex numbers. Here, we represent the independent variable as $z = x + yi$, and the function value as $f(x) = u + vi$. This results in four variables, requiring a four-dimensional space to represent the function's image, which exceeds typical understanding. However, we can still find a solution. By using a false-color map, we can represent the three variables x , y , and u , while the fourth variable, v , is depicted using different colors^[13]. With the aid of MATLAB software, the function image is shown in **Figure 5**. In two-dimensional space, the function $f(z) = z^2 + 1$ indeed has two intersections with $u = 0$, which occur at $\pm i$.

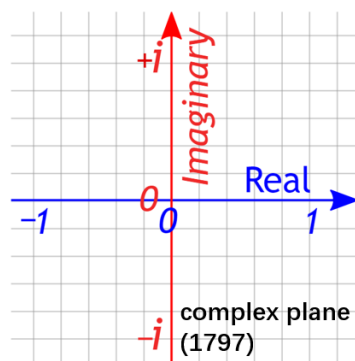


Figure 4. Complex plane representation of complex numbers.

At the same time, complex numbers are essential in physics as shown in **Figure 6** ^[14]. In Schrödinger's equation in quantum mechanics, i appears, which means that in order for the Schrödinger equation to have a solution, the wave function describing microscopic particles must be a complex number. The introduction of complex numbers not only ensures the existence of a solution to the equation but also provides a natural description of the phase evolution and probability amplitude of the wave function of microscopic particles. As Freeman Dyson stated, the $\sqrt{-1}$ in Schrödinger's equation signifies that nature operates through complex numbers, rather than real numbers ^[15].

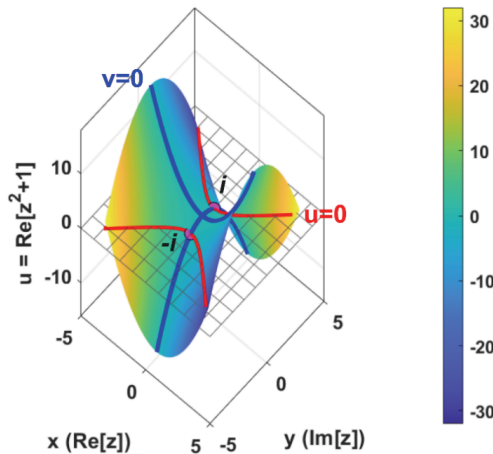


Figure 5. Visualization image of the roots of the equation .

Teaching functions of a complex variable in a mathematical physics methods course offers students a deeper understanding of the nature and significance of complex numbers by integrating both historical context and practical applications. The introduction of complex numbers originated from the necessity of solving cubic equations, which in turn led to the development of imaginary numbers and the complex plane. By conceptualizing complex numbers as two-dimensional quantities and visualizing them through geometric representations and rotational interpretations, students can better appreciate their real-world relevance and importance. In physics, the essential role of complex numbers in quantum mechanics further underscores their indispensability in describing microscopic phenomena. This teaching approach, grounded in the principles of scientific cognition, not only helps students acquire theoretical knowledge but also fosters their scientific literacy and enhances their ability to think innovatively.

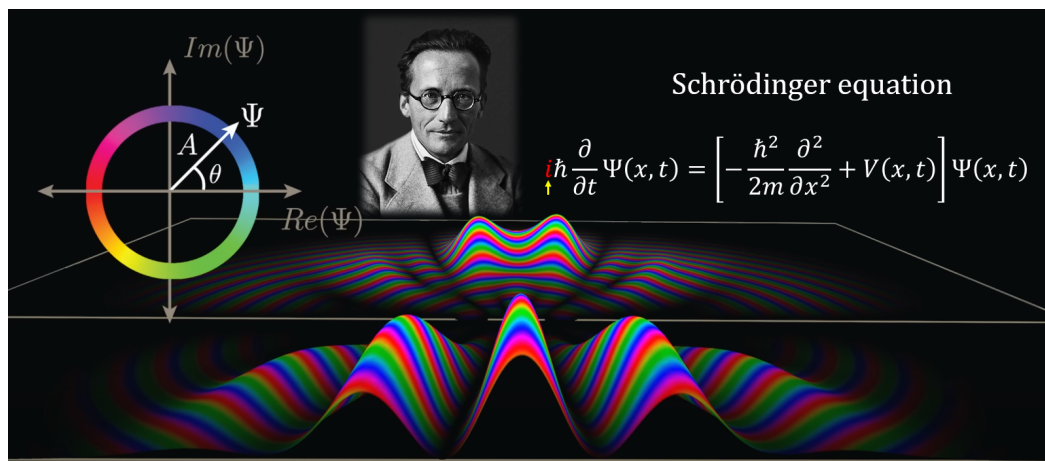


Figure 6. Schrödinger and the Schrödinger equation.

Funding

Research Project on Teaching Reform of Shaanxi University of Science and Technology (Project No.: 23Y083); Project of National Research Society of Mathematical Physics Methods in Colleges and Universities (Project No.: JZW-23-SL-02); Project of Graduate Course Construction of Shaanxi University of Science and Technology (Project No.: KC2024Y03); Research Project on 2024 National Higher Education University Physics Reform Research Project (Project No.: 2024PR064); Teaching Reform Research Project of the International Office of Shaanxi University of Science & Technology (Project No.: YB202410); Graduate Education and Teaching Reform Research Project of Shaanxi University of Science & Technology (Project No.: JG2025Y18)

Disclosure statement

The author declares no conflict of interest.

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Practice and Effectiveness Analysis of Teaching Reform Integrating “Interdisciplinary Integration + Case-Based Teaching + Multi-Dimensional Evaluation”

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Abstract: Based on the first-class course construction project of Diagnostics and the high-quality demonstration course project for postgraduate education at Fujian University of Traditional Chinese Medicine, this paper systematically analyzes the implementation effect of the teaching model integrating “interdisciplinary integration + case-based teaching + multi-dimensional evaluation” in the course, using course application materials and questionnaire survey data from 66 students. The study introduces innovative teaching methods such as Problem-Based Learning (PBL), flipped classroom, role-playing, and failed case teaching, and closely integrates the successful experience of Professor CHEN Zhibin’s Fujian Provincial Famous TCM Physician Studio in the diagnosis and treatment of lung impediment (feibi in TCM terminology). On this basis, a new assessment system featuring “progressive evaluation + multi-dimensional assessment” is constructed. Survey data show that students’ satisfaction with practical training courses and internship courses reaches 8.8 points and 8.94 points respectively (out of 10 points), and 74.24% of students prefer the content of internship courses the most. The teaching reform has significantly improved students’ clinical thinking ability and practical operation skills, providing replicable experience for the construction of clinical medicine courses.

Keywords: Diagnostics; Teaching reform; PBL teaching; Clinical thinking; Course construction

Online publication: October 21, 2025

1. Introduction

As a bridging discipline connecting basic medicine and clinical medicine, Diagnostics plays a crucial role in the medical education system. Postgraduate education is an important component of modern university education, representing a country’s highest level of education, and has distinct training objectives different from undergraduate education ^[1]. Diagnostics, as a basic skill that postgraduates must master before officially entering clinical practice, is therefore a top priority in medical students’ educational journey. With the transformation of medical education models and the increasing requirements for clinical practice, the traditional teaching method

centered on theoretical lectures can hardly meet the needs of cultivating outstanding medical talents. To adapt to the development and changes of the times, the online-offline blended teaching method has stood out in medical education models^[2,3].

In the author's previous research^[4], it was found that the "interdisciplinary cooperation" teaching model centered on case-based teaching was recognized by most students, with remarkable teaching effects worthy of promotion. Therefore, based on the university-level first-class undergraduate course construction project and the postgraduate education high-quality demonstration course project, the author further carried out systematic teaching reform exploration to address the existing problems in current teaching, such as the disconnection between theory and practice and insufficient cultivation of clinical thinking ability. Meanwhile, the successful experience of Professor CHEN Zhibin's Fujian Provincial Famous TCM Physician Studio in the diagnosis and treatment of lung impediment was closely introduced into case-based teaching.

By analyzing questionnaire survey data from 66 students, this study comprehensively evaluates the implementation effect of the teaching reform. With "interdisciplinary cultivation" and "role-playing + excellent cases of famous physicians + real failed cases" as the core, the reform innovatively incorporates both the successful cases of Professor CHEN Zhibin's Studio in treating lung impediment and real clinical failed cases into the teaching process, and constructs a diversified teaching evaluation system. The research results not only provide empirical evidence for the construction of the Diagnostics course but also offer reference experience for the reform of clinical medicine-related courses.

2. Background and objectives of teaching reform

2.1. Analysis of the current status of the course

Diagnostics is a core course for clinical medicine majors, covering multiple modules such as symptomatology, physical examination, laboratory diagnosis, and auxiliary examination. The traditional teaching model has the following prominent problems:

- (1) Separation of theory and practice: Classroom teaching mainly focuses on the explanation of knowledge points, and students lack opportunities to apply theoretical knowledge to clinical scenarios. A questionnaire survey showed that before the reform, only 21.21% of students were interested in the content of theoretical courses.
- (2) Single teaching method: Over-reliance on teachers' lectures leads to students passively accepting knowledge, with a lack of active thinking and exploration. Some students reported that "the teacher just reads the PPT in class, which makes me feel exhausted mentally".
- (3) One-sided evaluation method: Excessive emphasis is placed on the final written examination, while formative evaluation of students' clinical thinking and practical abilities is ignored. Approximately 34.85% of students believed that the original evaluation method was "not very reasonable" or "very unreasonable."

2.2. Setting of reform objectives

Based on the above problems, the course team has established three major reform objectives:

- (1) Knowledge integration objective: Break down disciplinary barriers and promote the organic integration of basic medical knowledge and clinical practice. Through interdisciplinary teachers' collaborative teaching and interdisciplinary training, students build a systematic knowledge system of diagnostics.

- (2) Competence development objective: Focus on improving students' clinical thinking ability, doctor-patient communication ability, and teamwork ability. Adopt a "role-playing" model to enable students to master diagnostic skills in simulated real clinical scenarios.
- (3) Literacy cultivation objective: Integrate medical humanities education to cultivate students' "people-oriented" professional values and rigorous and realistic scientific attitude. Through the teaching of failed cases, strengthen students' sense of responsibility and risk awareness.

3. Implementation plan for teaching reform

3.1. Development of teaching team

The course team is led by the director of the teaching and research section and brings together senior physicians from 5 departments of the Second Clinical Medical College:

- (1) Team composition: It includes 3 associate chief physicians and 2 attending physicians, covering the departments of cardiovascular medicine, respiratory medicine, gastroenterology, critical care medicine, and medical technology, with an average of 12 years of clinical work experience.
- (2) Division of labor and collaboration: The "modular responsibility system" is adopted, where each teacher undertakes the corresponding teaching content based on their professional expertise. In particular, the teaching of internship courses and practical training courses is more detailed and professional.
- (3) Teacher training: Regular training on new teaching methods such as Problem-Based Learning (PBL) and flipped classroom is carried out to ensure the unification of teaching concepts and standardization of teaching methods. Three group lesson preparations and two demonstration class observations are organized each semester.

3.2. Reconstruction of teaching content

3.2.1. Reform of theoretical teaching

- (1) Framework-based teaching: Teachers use blackboard writing to establish a knowledge framework and require students to draw mind maps after class. According to a survey, 60.61% of students believe that this method is helpful for systematizing knowledge.
- (2) Microlecture preview: Twenty clinical micro-videos on typical symptoms and signs have been developed, each lasting 3-5 minutes, for students to preview before class. These include on-site shooting of content such as dyspnea and heart murmurs.
- (3) Case introduction: Each class starts with a typical case, which runs through the entire teaching process. For example, in the chapter on "chest pain", differentiated cases such as acute myocardial infarction, pulmonary embolism, and pneumothorax are used for comparative teaching.

3.2.2. Innovation in practical teaching

- (1) Application of standardized patients (SP): Twelve standardized patients have been trained to simulate 20 common clinical symptoms. Students are divided into groups to conduct medical history collection, and teachers give on-site comments. According to a questionnaire, 83.33% of students believe that SP teaching has significantly improved their inquiry ability.
- (2) Multi-station practical training: Six practical training stations are set up, including pulmonary physical examination, cardiac physical examination, abdominal physical examination, neurological

physical examination, and genital physical examination. Specialized teachers guide each station. The “demonstration-practice-feedback” cycle model is adopted to ensure that each student receives sufficient guidance.

- (3) Failed case teaching: Fifteen typical clinical misdiagnosis cases are carefully selected, such as misdiagnosing appendicitis as gastroenteritis and pulmonary embolism as coronary heart disease. Students analyze the causes of errors and propose improvement plans. A student wrote in the questionnaire: “Failed cases have made me deeply realize the importance of rigorous diagnosis.”
- (4) Inheritance of famous physicians’ academic achievements: Ten successful cases of treating lung impediment (a TCM term) from the Fujian Provincial Famous TCM Physician Chen Zhibin’s Studio are carefully selected, including several excellent cases included in the TCM Clinical Case Achievement Database of China ^[5,6]. These cases emphasize the inheritance of TCM classic theories and famous physicians’ academic thoughts, while fully integrating the guidance of the thinking mode of integrating Chinese and Western medicine. A student wrote in the questionnaire: “I have deeply realized that for the development of TCM, neither inheritance nor innovation is indispensable.”

3.3. Innovation in teaching methods

3.3.1. Implementation of PBL teaching

- (1) Case design: Ten PBL teaching cases have been developed, with each case containing 3-4 progressive clinical scenarios. For example, in the case of “recurrent fever for further investigation,” laboratory test results are gradually provided as the condition progresses.
- (2) Group learning: Students are divided into groups of 15, with one group leader assigned to each group. Through literature research and discussions, groups formulate preliminary diagnoses and create PPTs for presentation. Teachers mainly play the role of facilitators.
- (3) Cross evaluation: Mutual evaluation among groups accounts for 15% of the final score, with evaluation indicators including the breadth of literature research, logical rigor, and presentation performance. According to a survey, 74.24% of students consider PBL courses the most rewarding.

3.3.2. Practice of flipped classroom

- (1) Pre-class tasks: Teachers release learning task sheets one week in advance, which include micro-videos, literature materials, and thinking questions. Students are required to record their learning doubts.
- (2) In-class interaction: Teachers focus on answering common questions, and students present their learning outcomes in groups. For instance, in ECG teaching, students need to explain the mechanisms and clinical significance of typical ECG changes.
- (3) Post-class extension: Clinical scenario assignments are given, such as “How to arrange the examination process for a patient complaining of chest pain.” Excellent assignments are displayed on the course platform.

3.3.3. Role-playing teaching

- (1) Role assignment: Students are divided into groups of 5, taking on the roles of patients, family members, attending physicians, nurses, and medical technicians respectively. Detailed role background materials are provided.
- (2) Scenario simulation: Eight clinical scenarios are set, such as “informing a patient of a malignant tumor

diagnosis” and “handling medical disputes.” Emphasis is placed on doctor-patient communication skills and team collaboration.

- (3) Reflection and summary: The simulation process is recorded, and the strengths and weaknesses in communication are analyzed through playback. Teachers focus on commenting on issues related to humanistic care, ethics, and laws.

3.4. Reform of the evaluation system

A diversified “progressive assessment + multi-dimensional evaluation” system has been constructed:

- (1) Process-oriented assessment (20%):
 - Attendance and class participation (2%)
 - In-class quizzes (3%)
 - Case analysis assignments (5%)
 - PBL in-class performance (10%)
- (2) Formative assessment (30%):
 - Mid-term exam (10%)
 - Practical operation assessment (20%)
- (3) Summative assessment (50%):
 - Final exam (50%)
- (4) 360-degree evaluation:
 - Teacher evaluation of students (50%)
 - Mutual group evaluation (30%)
 - Patient satisfaction (20%, evaluated by Standardized Patients/SPs)

According to a questionnaire survey, after the reform, 85.29% of students consider the evaluation system “very reasonable” or “relatively reasonable,” which is a 50-percentage-point increase compared with the period before the reform.

4. Analysis of the effectiveness of teaching reform

4.1. Evaluation of students’ learning outcomes

Through statistical analysis of 66 questionnaire responses, the teaching reform has achieved remarkable results:

- (1) Improved course satisfaction: The overall course rating by students is 8.18 out of 10. Among all courses, practical training courses and internship courses received the highest ratings, at 8.8 and 8.94, respectively. Additionally, 46.97% of students gave a full-score evaluation.
- (2) Preferences for teaching content: 74.24% of students favor internship courses the most, 60.61% prefer practical training courses, and 34.85% choose Problem-Based Learning (PBL) courses. One student commented, “Internship courses allow us to have close contact with real cases, and the gains from this are far beyond what we can learn from textbooks.”
- (3) Recognition of competence improvement: 91.23% of students believe the reform has significantly enhanced their clinical thinking ability; 87.67% feel their communication skills have improved; and 83.45% acknowledge progress in their teamwork ability.
- (4) Positive evaluation of teachers: Most teachers are highly praised by students for being “vivid in teaching” and “rich in clinical experience.” Many students specifically mentioned that “the successful cases of

diagnosing and treating lung impediment (Feibi) from Chen Zhibin's Fujian Provincial Famous TCM Doctor Studio have benefited them a lot."

4.2. Achievements in teaching innovation

- (1) Development of teaching resources: A standardized patient case library (20 cases), a teaching case library of failed cases (15 cases), and a micro-lecture video resource library (20 videos) have been developed, forming a complete teaching resource system.
- (2) Innovation in teaching methods: New teaching methods such as PBL teaching, flipped classroom, and role-playing have been successfully and systematically introduced into the curriculum, exploring a blended teaching model suitable for clinical medical education.
- (3) Reform of the evaluation system: The established diversified evaluation system can assess students' learning process throughout the course in a more fair, comprehensive, and scientific manner, and it can be further promoted in other affiliated teaching hospitals.
- (4) Enhanced teacher-student interaction: The new teaching model has tripled the frequency of teacher-student interaction, and the average weekly extra-curricular guidance time has increased by 2 hours.

4.3. Characteristics and innovation points of the reform

- (1) Interdisciplinary teaching: Making full use of the multi-disciplinary advantages of affiliated teaching hospitals, resources of teachers from different specialties are integrated to provide students with a comprehensive clinical perspective. For example, a case of "dyspnea" is jointly analyzed by teachers from the respiratory department, cardiology department, and critical care medicine department.
- (2) Teaching with excellent cases from famous doctors: Excellent cases selected into the China TCM Clinical Case Achievement Database from famous doctor studios are introduced into teaching, strengthening students' understanding of the inheritance of TCM classic theories and the academic thoughts of famous doctors^[7].
- (3) Teaching with real failed cases: Breaking the limitation of traditional teaching that only focuses on successful cases, well-selected misdiagnosis cases with educational value are used to cultivate students' risk awareness and critical thinking^[8]. A student's feedback from the questionnaire stated, "The failed cases are unforgettable for me and serve as a constant reminder."
- (4) Integration of standardized patients and role-playing: Through highly simulated clinical scenario simulations, students can practice repeatedly in a safe environment, which not only improves their skills but also cultivates their humanistic care awareness. The average score of practical operation assessments has increased from 72.5 to 86.3.
- (5) Whole-process diversified evaluation: Breaking the traditional evaluation model of "one exam determining lifelong outcomes," the reform emphasizes formative evaluation of the learning process, making the evaluation more scientific, comprehensive, and fair^[9].

5. Problems and improvement directions

5.1. Main existing problems

- (1) Difficulty in case selection: Failed cases involve the risk of medical disputes, requiring a balance between educational value and patient privacy protection. Approximately 12.5% of students reported that some

cases lack sufficient representativeness.

- (2) Increased workload for teachers: New teaching methods require teachers to invest more time in preparing cases and guiding group learning. The average weekly workload of teachers has increased by 8-10 hours.
- (3) Differences in students' adaptability: 15.2% of students reported initial difficulty in adapting to the active learning model, and students with weak foundations, in particular, face significant pressure.
- (4) Resource constraints: The number of standardized patients is insufficient, and simulation equipment needs to be updated. Some students suggested "increasing investment in hospital internship resources."

5.2. Continuous improvement plan

- (1) Optimization of the case library: Establish a three-level case screening mechanism, with a focus on excellent cases from renowned doctor studios, to ensure the educational value, safety, and representativeness of cases^[10]. It is planned to update 30% of the cases annually^[11].
- (2) Construction of a teacher echelon: Implement the "Qinglan Project" (a mentoring program for young teachers), where each senior title teacher guides 1-2 young teachers. Establish a special reward fund for teaching reform^[12].
- (3) Exploration of hierarchical teaching: Design learning tasks of varying difficulty levels based on students' foundational differences and establish mutual-aid learning groups^[13].
- (4) Resource integration and upgrading: Apply for special funds to expand the clinical skills center and increase investment in standardized patient training. Collaborate with other affiliated hospitals to build a joint teaching case resource platform.
- (5) Informatization construction: Develop virtual simulation experimental projects, such as the "3D Lung Auscultation Training System," to make up for the shortage of practical training opportunities.

6. Conclusion

Through a systematic analysis of the reform practices of the "Diagnostics" first-class course construction project and the postgraduate education excellent demonstration course project, this study confirms the effectiveness of the teaching model of "multidisciplinary integration + case-based teaching + multi-dimensional evaluation." By innovating teaching methods, reconstructing teaching content, and improving the evaluation system, the reform has significantly enhanced students' clinical competence and professional literacy. Questionnaire data show that students' satisfaction with practical training courses and internship courses reached 8.8 points and 8.94 points, respectively, and 74.24% of students rated internship courses as their favorite learning content, which verifies the correctness of the reform direction^[14].

In the future, the course team will further deepen teaching reform in the following aspects: On one hand, expand the application scope of excellent cases from renowned doctor studios and real clinical failed cases in teaching, and develop clinical cases with greater educational value. For the teaching activities of medical professional degree postgraduates, efforts can be made to further stimulate their potential in exploring excellent cases and proactively conducting academic discussions. The joint construction of case libraries by teachers and students holds important significance for teaching and clinical practice. On the other hand, strengthen the construction of informatization teaching resources and make up for the limitations of practical teaching through virtual simulation technology. At the same time, promote the reform experience to subsequent clinical courses such as "Internal Medicine" and "Surgery," forming a coherent clinical competence training system. The ultimate

goal is to cultivate outstanding medical talents with noble medical ethics, exquisite medical skills, innovative spirit, and international perspective^[15].

Funding

The 3rd Batch of Provincial Excellent Postgraduate Teaching Case Construction Projects of Fujian Provincial Department of Education (Project No.: Min Higher Education [2024] No.30); 2024 Clinical-Style University-Level First-Class Undergraduate Course Construction Project of Fujian University of Traditional Chinese Medicine (Project No.: Min Traditional Chinese Medicine Education [2024] No. 96); 2024 University-Level Professional Degree Postgraduate Teaching Case Construction Project of Fujian University of Traditional Chinese Medicine (Project No.: Min Traditional Chinese Medicine Research [2024] No. 17)

Disclosure statement

The authors declare no conflict of interest.

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Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Research on the Application of VR Technology in the Simulation Training of Sanda Actual Combat Scenarios

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Abstract: Addressing the limitations of traditional Sanda training, this study thoroughly explores the application prospects of VR technology. Based on constructivism, flow theory, and embodied cognition, a VR Sanda training system is constructed to provide a safe, controllable, and highly realistic training environment for Sanda, promoting the transformation of Sanda training mode from “experience-led” to “technology-empowered,” and offering new insights for the innovation of competitive sports training models.

Keywords: VR technology; Sanda; Actual combat scenario simulation; Training system

Online publication: October 21, 2025

1. Introduction

In 2018, the Ministry of Education issued the “Educational Informatization 2.0 Action Plan,” aiming to implement the spirit of the 19th National Congress of the Communist Party of China, promote “Internet + Education,” and accelerate educational modernization ^[1]. In the same year, the Ministry of Industry and Information Technology issued guidance documents, focusing on promoting the development of “VR+” ^[2]. In October 2021, the General Administration of Sport of China issued the “14th Five-Year Plan for Sports Development,” which clearly proposed to promote the development of emerging sports such as virtual sports and implement the “Sports+” project ^[3]. As an advanced simulation technology, virtual reality can virtualize things that are difficult to present intuitively in the real world and display them vividly in a three-dimensional manner, bringing users an immersive experience. As a product integrating traditional Chinese martial arts and modern competitive sports, Sanda faces problems such as the risk of injury due to physical confrontation in actual combat and poor training effectiveness. Based on this, this study aims to analyze the application prospects of VR technology in the simulation training of Sanda actual combat scenarios, hoping to provide theoretical support for the in-depth application of VR technology in competitive sports.

2. Overview of Virtual Reality technology

Virtual Reality (VR) technology is a computer simulation system that can correspond and integrate the “real world” with the “virtual world.” Scholars generally consider this technology to be the third fundamental method for humans to understand the objective laws of nature, following mathematical reasoning and scientific experimentation. Its main characteristics are immersion, interactivity, multi-perceptivity, imagination, and autonomy^[4]. The key technologies include: (1) dynamic environment modeling technology; (2) real-time three-dimensional graphics generation technology; (3) stereoscopic display and sensor technology; (4) application system development tools; (5) system integration technology^[5].

3. Theoretical basis for virtual scenario construction

3.1. Constructivism learning theory

Constructivism learning theory is a theory related to knowledge and learning, proposed by J. Piaget *et al.* based on cognitive processing theory^[6]. The constructivist view of knowledge holds that the construction of knowledge relies on diverse environments, and knowledge itself is not a direct reflection of the real world, but rather an interpretation and hypothesis of phenomena^[7]. Therefore, when facing different environments, learners should rely on their existing knowledge and experience to construct knowledge meaningfully, thereby forming a new understanding of knowledge.

3.2. Flow theory

Flow Theory, also known as Immersion Theory, refers to the deep state of immersion and joyful experience felt when an individual is fully engaged in an activity, reaching complete focus and immersion^[8]. Flow experience is characterized by a balance between challenge and skill, clear goals, immediate feedback, the merging of action and awareness, complete absorption, a sense of control, the loss of self-consciousness, and intrinsic motivation^[9]. Therefore, to effectively apply flow theory, attention should be paid to the interaction between students' immersive experience and time limits of the game, enabling learners to achieve a state of deep learning while effectively preventing and controlling the phenomenon of game addiction.

3.3. Embodied cognition theory

Embodied cognition theory emphasizes the important role of bodily experience in the construction of knowledge and meaning. Unlike traditional teaching, which focuses on the role of the brain in the learning process, embodied learning theory advocates for the “whole person,” including the body, emotions, senses, and mind, as the medium of learning, and emphasizes the “physical aspect” in meaningful activities^[10]. Therefore, teachers should make full use of the multimodal field of the body to create new teaching meanings through encoding, decoding, understanding, transformation, and recording.

4. System module design and development

4.1. Virtual scenario system module design

The module design adopted by the VR Sanda training system includes four core functional modules, with the technical implementation and cognitive training logic as follows:

- (1) System Navigation Module

The system navigation module serves as the entry point for user-system interaction, enabling users to initially interact with the system through handheld controller operations. This module employs a three-level navigation hierarchy (main menu - mode selection - difficulty grading), combined with visual focus guidance technology and haptic vibration feedback mechanisms, ensuring that users' spatial orientation and decision-making in the virtual environment align with the requirements of cognitive load theory.

(2) Multimodal motion acquisition module

The multimodal motion acquisition module integrates motor skill learning theory to construct an educational system based on the three-dimensional aspects of vision, kinesthesia, and audition. It demonstrates standardized movement trajectories through video, highlights the technical characteristics of Sanda, explains key technical points synchronously through voice, and uses text prompts to focus users' attention on the key and difficult points of the movements, thereby reinforcing users' motion cognition.

(3) Hierarchical defense training module

Based on the progressive principle of skill transfer, the hierarchical defense training module is designed with two differentiated sub-modules: (A) Structured combination practice mode: For example, a fixed attack sequence of left jab, right cross, left roundhouse kick, and right cross is preset. The module uses a recurrent neural network to control the action rhythm of the virtual character, enabling users to develop a conditioned reflex mechanism for defensive movements. (B) Dynamic adaptive mode: This mode employs a deep reinforcement learning framework, allowing the virtual character to dynamically generate attack commands based on probability models and behavior tree algorithms, making its action combinations capable of simulating the unpredictability of real combat scenarios.

(4) Training data visualization

Based on big data analysis technology, the system constructs an evaluation index system that includes dimensions such as movement fluency, reaction time, and defense success rate. It also utilizes the Unity 3D engine to generate a heatmap of defense blind spots and produces a diagnostic report on skill weaknesses, providing data support for training optimization.

4.2. Development platform for the virtual scenario system

Unity Technologies, as an industry benchmark for cross-platform game development engines, features technical architecture with ecological compatibility and development friendliness. Unity's engine employs a modular compilation system, and its development environment supports both Windows and macOS operating systems, while also offering multi-terminal compilation and adaptation capabilities, allowing for one-click generation of localized executable files for mainstream platforms such as Windows, Mac, and Android^[11,12]. Unity 3D supports multi-paradigm programming languages such as C# and JavaScript. Among them, C#, with its object-oriented design and efficient exception handling functions, forms a deep synergy with Unity's entity component system. Its simple operation interface and personalized settings greatly save development time and costs^[13].

4.3. Diversified tactical scenario design empowered by VR technology

In Sanda's actual combat training, the cultivation of tactical decision-making ability and on-site adaptability relies on a complex and changeable confrontation environment. This can be achieved by constructing a three-dimensional tactical space using VR technology, thereby realizing diversified tactical simulations. During the construction of the virtual space, actual combat scenarios with different terrains are simulated. The physical

engine performs real-time calculations of the center of gravity shifts of the human body, forcing athletes to adjust their movement strategies. Additionally, environmental interference simulations, such as flashbulb disturbances and increased audience shouting, are used to enhance the athletes' environmental perception threshold.

5. Analysis of the application of VR technology in the Sanda actual combat scenario training

5.1. Teaching material analysis

The Sanda course textbook is a specialized Material designed for Sanda teaching in universities. It typically includes the basic theories, technical key points, training methods, and competition rules of Sanda. It provides students with a systematic and comprehensive learning resource, helping them receive comprehensive training and improvement in Sanda. However, the slow update speed of the textbook may lead to a mismatch between the teaching content and the development of Sanda, and the lack of actual combat cases in the textbook is not conducive to students' understanding and application. Therefore, the application of VR technology in the Sanda actual combat scenario simulation training can provide students with a new training method.

5.2. Analysis of student conditions

As one of the traditional martial arts in China, Sanda is rich in cultural connotations and practical value. The goal of the Sanda course is to teach students basic Sanda techniques, improve their physical fitness through training, enhance their self-protection abilities, and cultivate brave, confident, and tenacious personality traits. College students are in the late stage of adolescence, with their physical development basically mature, and they are full of energy, with high levels of physical fitness and athletic ability^[14]. Given the confrontational nature of Sanda, students must learn how to effectively avoid injuries during the learning process, as well as strategies for protecting themselves while respecting their opponents in actual combat. Confrontational training and competitions may trigger psychological barriers such as fear and tension in students, which not only affect the normal performance of techniques but may also diminish their enthusiasm for learning^[15]. Therefore, integrating virtual reality technology into the teaching of Sanda courses can provide students with a safer and more controllable learning environment, effectively reducing psychological barriers, improving learning efficiency, and enhancing actual combat skills.

5.3. Analysis of teaching objectives

(1) Knowledge and skill objectives

Through learning, students will master the basic theoretical knowledge of Sanda, including technical key points, tactical applications, and rule understanding. They will also learn to use VR equipment for Sanda actual combat simulation training, thereby improving their observation, judgment, and reaction abilities in actual Sanda combat.

(2) Process and method objectives

Through VR simulation training, students can experience different actual combat scenarios, enhancing their situational adaptability; cultivate students' ability to analyze opponents' movements and formulate tactical strategies in the VR environment; thereby strengthening students' technical application and tactical execution abilities in actual combat.

(3) Affective attitude and values objectives

Cultivate students' courage and confidence in facing challenges, reducing tension and fear in actual combat training. Emphasize the spirit of sportsmanship during the learning process, cultivating students' values of respecting opponents and fair competition. Through teamwork and communication, enhance students' sense of collective honor and team spirit.

5.4. Analysis of teaching key points and difficult points

(1) Teaching key points

This course is dedicated to creating highly realistic combat scenarios, ensuring that students can obtain an experience similar to actual matches in the VR environment. In addition, the teaching process will focus on guiding students on how to correctly use and operate VR equipment, enabling them to train in a safe environment and flexibly apply Sanda techniques in different VR simulated scenarios.

(2) Teaching difficult points

Students' adaptability to VR technology, especially the sense of immersion and realism in simulated combat, is crucial. Therefore, the teaching process needs to focus on the fine-tuning of Sanda technical movements to ensure the accuracy and fluency of execution. Through the cultivation of psychological qualities in actual combat, students can overcome nervousness and fear in confrontations. By constructing a teaching evaluation system, a scientific system can be established to objectively and effectively evaluate students' performance and progress in VR Sanda actual combat simulation training.

6. Conclusion

VR technology, with its characteristics of immersion, interactivity, and multi-perceptivity, breaks through the limitations of traditional Sanda training, providing athletes with a safe, controllable, and highly realistic training environment. Through the design and development of modules such as virtual scenario construction, multimodal action learning, hierarchical defense training, and training data visualization, it can not only improve the scientificity and safety of training but also inject new momentum into the sustainable development of Sanda.

Funding

Postgraduate Innovation Special Fund, "Design and Application Exploration of Sanda Actual Combat Scenario Course Based on VR Technology" (Project No.: YC2024-X11)

Disclosure statement

The authors declare no conflict of interest.

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Standardizing the Artistic Evaluation of Foreign Literature in Higher Education Textbooks

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Abstract: Different higher education textbooks make different artistic evaluations of the same foreign literature, which brings difficulties to students and teachers. The main reasons are as follows: Firstly, there is confusion between “artwork” and “artistic process”; Secondly, there is a shift between personalized appreciation and scientific evaluation. Given that the institutionalization of literary research is a development trend, it is necessary to standardize artistic evaluations.

Keywords: Higher education textbook; Foreign literature; Artistic evaluation; Literary criticism; Literary history

Online publication: October 16, 2025

1. Introduction

Different higher education textbooks have made varying artistic evaluations of the same foreign literature, causing confusion in studying and researching, especially in examinations and grading^[1]. It is essential to identify the causes and propose appropriate solutions.

2. Different artistic evaluations

Different textbooks offer varying artistic evaluations of the same foreign literature, with a prime example being the divergent evaluations for classic works^[2]. It appears that Chinese scholars and textbook compilers still hold conflicting views. This inconsistency, though surprising, is a reality. For instance, the evaluation of Shakespeare’s dramatic artistic achievements is a crucial matter concerning the understanding of the artistic essence of Western literature^[3]. However, prevalent textbooks still present a range of conflicting perspectives on this issue, failing to reach a unanimous conclusion.

The “Key Textbook of Marxist Theory Research and Construction Project” (MTRCP), published in 2015, discusses this issue as follows:

Shakespeare stands as a preeminent master of dramatic art. He achieved unparalleled accomplishments, including historical plays, comedies, and tragedies. The gallery of stage characters he created transcends

mere mouthpieces for authorial ideology or “zeitgeist manifestations,” instead emerging as vivid characters with complex personalities rooted in real lives ^[4]. His dramatic plots demonstrate innovative adaptation from conventional structures, flexibly orchestrated to serve thematic requirements rather than rigid doctrines, embodying what Friedrich Engels praised as “vividness and richness of plot.” Renowned for their linguistic diversity and vivid imagery, Shakespeare’s dramatic language not only significantly enhanced theatrical expressiveness but also made exceptional contributions to the maturation and refinement of the English language ^[5]. These artistic achievements were concisely conceptualized by Karl Marx as “Shakespeareanization,” establishing an exemplary model for writers. Shakespeare’s enduring prominence through the centuries proves his immortal literary value.

The above content discusses the artistic characteristics of Shakespeare’s plays from three aspects: character, plot, and language, which are in line with convention ^[6]. Specifically, the characterization is defined through three aspects: “vivid characters,” “complex personalities,” and “rooted in real lives.” The plots are articulated through three aspects: “vividness and richness,” “innovative adaptation from conventional structures,” and “flexibly orchestrated to serve thematic requirements rather than rigid doctrines” ^[7]. Regarding linguistic artistry, the analysis employs definitive parameters such as “lexical opulence” and “imagistic vividness,” emphasizing the qualities that “make pioneering contributions to the evolution and perfection of the English.”

Given that the MTRCP series of textbooks is mandated by the Ministry of Education as the standardized textbooks for higher education institutions nationwide ^[8], it is reasonable to employ them as the model for evaluating the others.

The MTRCP History of Foreign Literature designates Professors Nie Zhenzhao, Zheng Kelu, and Jiang Chengyong as its principal academic experts. Professor Nie Zhenzhao, positioned as the primary authority, previously spearheaded the compilation of the “2014 History of Foreign Literature—a National-Level Elite Course textbook certified by China’s Ministry of Education” ^[9].

Compared with the MTRCP edition, the 2014 textbook has the following differences:

(1) Additions

“Organic synthesis of realism and romanticism” and “skilled at expressing life relationships in a broad range.”

(2) Enrichments

(A) Evolutionary reformulation of MTRCP’s “innovative adaptation of conventional forms” into “Transmutation of ‘pure theatrical structure’ into ‘epic architectural composition’.”

(B) “Strategic interlacing of multiple narrative threads within intensified dramatic conflicts, culminating in thematic convergence.”

(C) Protagonists situated in dual conflicts: environmental determinism vs. existential agency ^[10].

(D) Developmental dynamism (“evolutionary mutability”) as the core characterization principle.

(E) Soliloquy is identified as the quintessential device for manifesting such psychodynamic progression.

(F) Methodologically noteworthy quantification: The lexical inventory reaches 17,000 distinct terms substantiating qualitative descriptors like “lexical opulence”; Statistical verification enhances traditional evaluative parameters of linguistic “abundance.”

The remaining principal academic experts, Professor Zheng Kelu and Professor Jiang Chengyong, demonstrated their scholarly stewardship in 2006 by orchestrating the “History of Foreign Literature (Revised Edition),” a “Twenty-First Century-Oriented Curriculum” textbook, where Zheng served as the chief editor and

Jiang as the associate editor ^[11]. This textbook evaluates Shakespearean artistry through “Hamlet.” Compared with the MTRCP edition, it adds the artistic device of Shakespeare and the dichotomy approach in depicting the personalities.

The “History of Foreign Literature” designated for the Chinese Language and Literature major (undergraduate level) under China’s National Higher Education Self-Taught Examinations, published in 2001, retains substantial referential significance ^[12]. Compared with the MTRCP, it adds “documenting protagonists’ developmental trajectories” and “interior monologue.”

Commissioned by the State Education Commission, the 1985 edition of “History of Foreign Literature: Euro-American Volume,” authored by chief editors Zhu Weizhi and Zhao Li with contributions from seventeen faculty members across seven institutions in Beijing and Tianjin, received the Ministry of Education’s First-Class Outstanding Textbook Award and underwent multiple revisions, establishing its canonical status ^[13]. Compare with MTRCP, it reveals that Shakespeare’s dramas were composed in unrhymed iambic pentameter (blank verse).

3. Reasons and solutions

The main reasons are as follows: Firstly, there is confusion between “artwork” and “artistic process”. According to Abrams’ opinion, “art” in “art evaluation” generally refers to the ways and methods of handling the subject matter, that is, the process, methods, and techniques of “artisticization” with the goal of “artistic quality”. Subjects, themes, etc., should not be the objects of art evaluation ^[14]. Secondly, there is a shift between personalized appreciation and scientific evaluation. Traditional literary criticism encourages “personalized” appreciation of works, while modern literary history pursues “scientific” evaluation of works. There is a contradiction between the two approaches.

Standardizing the artistic evaluation of writers’ works faces many challenges and is extremely tricky. Due to the seriousness of this matter, this article provides some guiding opinions and suggestions in order to seek guidance from experts ^[15]. Firstly, it is necessary to clarify the concepts of five literary terms: subject matter (material), content (preliminary procedures such as selection and arrangement of material), characters (theme), ideas, and art, and to handle the overlapping content of the above five concepts as much as possible. Art (techniques/characteristics) should be understood and expressed in three main aspects: One refers to all “artistic” treatments that have a significant impact on the theme of the work and make the work itself an organic whole. Secondly, it refers to the significance and value of the aforementioned artistic techniques in all of the author’s creations. The third refers to the significance and value of the aforementioned artistic techniques in literary history. Given that the institutionalization of literary research is a development trend, it is necessary to standardize artistic evaluations. This mainly refers to the need to eliminate non-standard and arbitrary evaluations on one hand, and to establish some standards for art evaluation on the other hand, such as defining the scope of evaluation, and evaluation standards.

4. Conclusion

In summary, the issue of differentiation in the evaluation of foreign literature and art in current higher education textbooks is significantly present. Its root lies in the confusion between the concepts of ‘artwork’ and ‘art process,’ as well as the conflicting positions of personalized appreciation and scientific evaluation. A comparison of multiple versions of textbooks on the evaluation of Shakespeare’s plays shows that there are notable discrepancies in the interpretive frameworks and parameter choices of different evaluation systems

regarding core dimensions such as character development, plot structure, and linguistic artistry. This not only affects the unity of teaching research but also reflects the ambiguity of literary evaluation standards. Given the institutional development trend of literary research, the normalization of art evaluation needs to start from clarifying the terminology categories of ‘theme-content-character-thought-art,’ defining the triple connotation of artistic techniques (organic handling of the artwork, value of the author’s creative lineage, significance of literary historical positioning), and establishing evaluation scope and criteria to eliminate non-normative evaluations. Ultimately, this aims to construct a scientifically unified evaluation system to promote the standardization and in-depth development of foreign literature teaching research.

Funding

Lingnan Normal University's 2022 University-level Teaching Quality and Teaching Reform Project, “Offline First-class Course ‘History of Foreign Literature’”

Disclosure statement

The author declares no conflict of interest.

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Construction of Teaching Innovation Teams of “Dual-Qualification” Teachers in Mechanical and Electrical Majors under the School-Enterprise Cooperation Model

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Abstract: With the advancement of economic globalization and the upgrading of industrial structures, the value of higher education in talent cultivation has become increasingly prominent. The construction of “dual-qualification” teacher teams is a crucial link in promoting educational work in colleges and universities. Schools should attach importance to teacher training to adapt to the current educational situation. Under the school-enterprise cooperation model, building “dual-qualification” teacher teams for mechanical and electrical majors helps ensure teaching mechanisms and provides support for the reform and innovation of higher education. Based on this, this paper conducts an in-depth study on the construction of teaching innovation teams of “dual-qualification” teachers in mechanical and electrical majors under the school-enterprise cooperation model, for reference.

Keywords: School-enterprise cooperation; Mechanical and electrical majors; “Dual-Qualification” teachers; Innovation teams; Teacher training

Online publication: October 21, 2025

1. Introduction

Against the backdrop of school-enterprise cooperation, schools and enterprises cultivate talents through cooperative models such as work-study alternation. This not only provides students with more opportunities for learning and practice but also delivers more high-quality talents to enterprises. To ensure the effective implementation of talent cultivation, schools and enterprises have built a “double-qualified” teaching team. This team imparts cutting-edge theories and practical skills to students, further promoting their all-around development. To deepen the process of teaching reform in colleges and universities, schools should strengthen school-enterprise cooperation, focus on the construction of teaching teams, and promote the high-quality development of higher education.

2. Connotation and characteristics of “Dual-Qualification” teachers

2.1. Connotation

“Dual-qualification” teachers refer to full-time and part-time teachers in the university who hold a teaching qualification and meet at least one of the following conditions:

- (1) Possessing an intermediate or higher professional technical title (including intermediate level) and professional qualifications in their field (such as being a professional skill assessor or holding industry-authorized qualification certificates), and having presided over or participated in on-campus teaching practice projects in the past five years, which are at an advanced level among similar institutions in the province.
- (2) Having more than two years of working experience in frontline positions of their profession in enterprises within the past five years, and being capable of guiding students in professional practice and training activities.
- (3) Having presided over or participated in applied technological research achievements in the past five years, which have been adopted by enterprises and achieved good benefits ^[1].

2.2. Characteristics

(1) Professionalism

A team of dual-qualification teachers should possess solid disciplinary knowledge, research expertise, practical experience, and industry-specific knowledge. They form a development community to carry out scientific and systematic teaching practices, providing stronger support and guarantees for educational work and promoting students’ all-round development.

(2) Collaboration

The shift from individual dual-qualification to team-based dual-qualification represents a transformation in the structure and functions of the teaching staff, with collaboration being the key to team building. Establishing a teacher community that shares knowledge and skills can break the limitations of traditional teaching, better realize the sharing of teaching concepts and methods, and achieve teaching goals through division of labor and collaboration.

(3) Innovation

High-quality education requires corresponding teaching organizations. Compared with traditional theoretical teaching, the teaching teams of university “dual-qualification” teachers have built their teaching organizations based on professional needs. They reconstruct professional teaching clusters according to industrial chain and value chain demands, thereby ensuring internal collaboration ^[2].

3. Significance of building a “Dual-Qualified” teaching team for mechanical and electrical majors under the school-enterprise cooperation model

The construction of a “dual-qualified” teacher team serves as an important approach to promote high-quality development of teaching. Meanwhile, “dual-qualified” teachers in colleges and universities are also a practical need for college students to improve their comprehensive quality and abilities. In the context of the information age, various cultures interweave, and students’ values and ways of thinking have also changed. For this reason, under the school-enterprise cooperation model, mechanical and electrical majors should attach importance to the construction of “dual-qualified” teacher teams, cultivate high-quality talents, and address the current issue of low

educational efficiency.

3.1. Deepening school-enterprise cooperation

Against the backdrop of scientific and technological innovation and development, manufacturing enterprises have begun to move towards digitalization and intelligence. However, talent training should not deviate from enterprise production, as this may lead to aimless educational reforms. In this context, it is necessary to strengthen the construction of teacher teams, establish a new-era school-enterprise cooperation education mechanism, and further tap the potential of school-enterprise cooperation through the sharing of resources such as information, technology, and talents, thereby promoting educational development. In the process of innovating teaching methods and models for mechanical and electrical majors, the team should construct an interactive talent training model, establish multi-party cooperation relationships, clarify the requirements of enterprises and industries for mechanical and electrical talents, and then carry out teaching work in accordance with talent training requirements, further strengthening students' practical abilities to provide support for the long-term development of enterprises ^[3].

3.2. Promoting educational reform

For higher education, teachers are an important educational force. Building a “dual-qualified” teacher team can fully integrate advanced theories with practice, continuously update teaching content, enrich educational and teaching experience, create innovative educational models, and put forward higher requirements for the implementation of educational reform. If colleges and universities want to achieve the goal of talent training, they need to build a high-quality “dual-qualified” teacher team to further improve the quality and effectiveness of teaching, adapt to the development requirements of the new era, and build a teacher team with teaching qualifications and professional skills, which is also conducive to the development of teachers' own quality and abilities. Therefore, the construction of a “dual-qualified” team in colleges and universities is particularly crucial ^[4].

3.3. Improving the quality of talent cultivation

Building a “dual-qualified” teaching team helps to enhance the innovation ability of teachers in mechanical and electrical majors, thereby ensuring the quality and effectiveness of teaching and achieving good talent cultivation results. The knowledge system of mechanical and electrical majors is relatively complex, involving rich teaching knowledge ^[5]. College students may encounter difficulties in the learning process. However, “dual-qualified” teachers have solid theoretical knowledge and rich practical operational abilities. By introducing new educational concepts and methods in teaching, they can help guide students at different levels to choose appropriate professional learning content and methods according to their career development needs, further cultivating talents with a solid foundation to better serve local development.

4. Paths for building an innovative teaching team of “Dual-Qualification” teachers in mechanical and electrical majors under the school-enterprise cooperation model

4.1. Establish alliance organizations and optimize talent cultivation work

For the teaching work of mechanical and electrical majors in colleges and universities, strengthening the construction of dual-qualification teaching teams requires focusing on cooperation between schools and enterprises, establishing a sound cooperative relationship, and thus implementing the requirements of industry-

education integration. Specifically, it involves introducing authoritative experts and technically competent backbones from the industry to serve as mentors in schools, building an educational team led by renowned teachers, promoting the construction of innovative teams, guiding teacher training, and forming a hierarchical teaching team. The teaching team can be divided into professional innovation teams, structured teaching teams, and craftsman teams ^[6].

The professional innovation team focuses on solving development problems in the mechanical and electrical industry and innovating professional talent cultivation methods. Through an integrated connection mechanism between schools and enterprises, talents with industry background and experience in the mechanical and electrical field are invited to form a teaching team with the school's backbone teachers. This enables in-depth discussions on key issues in teaching, ensuring that professional construction aligns with the needs of industrial transformation and upgrading. The structured teaching team is formed from the perspective of integrating positions and courses. It absorbs outstanding industrial mentors and backbone teachers to participate in professional curriculum development, further promoting the reform and innovation of teaching materials. To ensure the team's overall level, schools should promote the reform and innovation of mechanical and electrical teaching materials through school-enterprise collaboration. The structured team builds its faculty based on the alignment of positions and courses, widely recruiting industrial mentors and backbone teachers to teach according to production needs, thereby guaranteeing the quality and effectiveness of teaching. Additionally, schools should select high-quality, high-skilled talents from the industry as technicians through school-enterprise cooperation to form an integrated teaching team. The craftsman team is built by absorbing skilled craftsmen and master technicians from the industry, jointly forming a high-level educational team. They collaborate on a series of mechanical and electrical-related innovative practical activities, integrate professional teaching resources for talent cultivation, and achieve corresponding teaching goals ^[7,8].

4.2. Integrate talent resources and build diversified innovative teams

Schools should strengthen cooperation with enterprises, integrate various talent resources, and build a professional teaching team consisting of professional leaders, backbone teachers, industrial mentors, and skilled craftsmen. Through division of labor and collaboration, a team cluster is formed to ensure the structure and hierarchy of team talents, promote teaching work, and support professional team construction.

For the innovative teaching team of “dual-qualification” teachers, considering the varying knowledge levels, industry backgrounds, and work experience of team members, it is necessary to promote the reform of mechanical and electrical teaching and adopt diversified training models to improve the team's overall level, ensuring members remain in a good teaching state. Professional leaders should focus on the construction of team engineering projects, establish master studios, conduct new technology research and skill inheritance, and promote teachers' participation in various practical projects through school-enterprise cooperation to enhance their professional competence and teaching abilities. For teachers in the innovative teaching team, the “excellence in craftsmanship” training project should be actively implemented. This requires teachers to form complementary pairs, conduct in-depth research on talent demand in local advanced manufacturing clusters, gain a better understanding of current production conditions in enterprises, accumulate rich industry experience, and lay a solid foundation for their in-depth participation in the construction of mechanical and electrical majors ^[9–11].

4.3. Build online platforms to boost industry development cooperation

To ensure the comprehensive practical capabilities of the “dual-qualification” teacher innovation team, enterprises

should collaborate to establish an integrated online-offline service mechanism to support the team's innovative practices. On one hand, schools should strengthen cooperation with enterprises to build certification and training bases for teachers and students of mechanical and electrical majors, organizing them to participate in training and internships at these bases. This helps improve teachers' comprehensive qualities through training resources. Moreover, schools should effectively utilize various enterprise resources to deeply participate in technological research and development projects, arrange teachers to engage in scientific research and technology-related work, collaborate in upgrading enterprise mechanical and electrical equipment, promote enterprise technology and product upgrading, and further enhance teachers' research and practical capabilities. Colleges and universities should also focus on building talent cultivation bases, such as regional industrial robot centers, introduce local robot centers, establish mechanical and electrical technology and product research teams, carry out multiple technical research projects, and organize teachers and students to participate in mechanical innovation design competitions, providing more support for teaching. On the other hand, colleges and universities should effectively apply various information technologies to build online service platforms such as smart classrooms and smart campuses. They should use information-based reflection tools to assist teachers in teaching, thereby promoting professional teaching reform and ensuring teaching quality and effectiveness^[12].

4.4. Strengthen system construction and promote teachers' all-round development

To effectively ensure the quality and effectiveness of teacher team construction, a more scientific and sound educational management system should be established. This system will encourage teachers to actively participate in teaching training and research activities, supervise their teaching work, and improve their professional competence. Establish a clear responsibility system to define the roles of members in the innovative teaching team, grant autonomy to teachers in various positions, and separate academic and administrative powers to ensure teachers' active participation in team construction activities. Colleges and universities should build a more scientific and improved school-enterprise cooperation management mechanism to ensure that both parties collaborate in building teacher teams, establish a two-way flow mechanism, and form a sound teacher structure system. In terms of teacher training and management, a clear division of responsibilities should be established to ensure multi-party participation in educational practice activities and the rationality of the teaching team^[13–15].

5. Conclusion

To sum up, in the context of school-enterprise cooperation, building a “double-qualified” teacher team requires giving full play to the advantages of schools, as well as using enterprises' production environments and resources to train teachers. This can improve teachers' professional quality and abilities, enrich their theoretical knowledge, and enhance their professional skills through practical training, thereby enabling them to better guide teaching work. For the mechanical and electrical major, efforts should be made to build a teacher team based on the characteristics of industrial development, carry out differentiated training, improve the overall quality and capabilities of the team, and perfect the power and responsibility mechanism to urge teachers to continue learning and developing.

Disclosure statement

The author declares no conflict of interest.

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Research on the Training Mode of New Energy Professionals under the Background of Industry-Education Integration

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Abstract: With the implementation of the “dual-carbon” concept and the rapid development of the energy industry, industry-education integration has gradually become an important path in the training of new energy professionals. Based on this, the author will focus on the basic requirements of the new energy industry for talents in the new era, systematically explore the construction of the training mode of new energy professionals under the background of industry-education integration, hoping to provide some references and help for readers.

Keywords: Industry-education integration; New energy major; Talent training

Online publication: October 17, 2025

1. Introduction

Against the backdrop of the accelerated transformation of the global energy structure towards low-carbonization and cleanliness, the new energy industry, as a core area of strategic emerging industries, has become an important engine driving the green development of the economy and society. Technological iteration and industrial upgrading have led to an explosive growth in the demand for professionals in this industry. Industry-education integration, as a key path to resolving the contradiction between supply and demand in talent cultivation, emphasizes the deep interaction between education and industry to achieve the organic integration of knowledge imparting and production practice. In this context, constructing a new energy professional talent cultivation model oriented by industrial needs, centered on school-enterprise collaborative education, and characterized by progressive ability stratification is not only an inherent requirement for improving the quality of talent cultivation, but also an inevitable choice to serve the country’s “dual-carbon” strategy and support the high-quality development of the new energy industry^[1].

2. The important value of the integration of the production and education concept in the cultivation of new energy professionals

2.1. Improving educational quality: Building a collaborative education system of “Industry, Education, Research and Application”

Under the traditional education model, teachers mostly focus on imparting theoretical knowledge, which leads to students' lack of practical ability and great limitations in technical vision, making it difficult for them to adapt to the rapid development of the new energy industry. However, through the means of integrating production and education, enterprises can directly participate in the formulation of talent training programs and integrate cutting-edge industry technologies into teaching content, ensuring that what students learn is seamlessly connected with what the industry needs. In terms of practical teaching, through the co-construction of training bases by schools and enterprises, enterprises provide real equipment and project scenarios, allowing students to deeply participate in real enterprise projects, so as to realize “learning by doing”, accumulate rich practical experience, and improve their ability to solve complex engineering problems ^[2].

At the same time, under the background of the integration of production and education, the construction of a “double-qualified” teacher team has also become an important part of teaching reform. Schools should encourage teachers to take temporary positions in enterprises and participate in technical research and development together, transforming industrial experience into teaching cases. They can also invite enterprise experts to enter the classroom to share front-line technical problems and solutions, realizing two-way empowerment between teaching and industry ^[3].

2.2. Enhancing students' competitiveness: achieving “Employment upon Graduation”

As a technology-intensive field, the new energy industry has extremely high requirements for talents' practical ability and innovative literacy, and the traditional education model is difficult to fully meet enterprise needs. The integration of production and education builds a dual-subject training platform of “school + enterprise”, introducing real enterprise projects and technical standards into the classroom, enabling students to directly contact cutting-edge industry technologies in the learning process, master the ability to solve practical problems, and effectively shorten the adaptation period from campus to workplace ^[4].

In the process of integrating production and education, enterprise mentors can transform market demand into teaching cases by participating in curriculum design and practical training guidance, improving students' professional cognition. Students can also deeply participate in enterprise R&D projects. This “work-study alternation” model not only enhances students' sensitivity to industry trends, but also enables them to have post-competency before graduation, directly matching enterprise employment needs. At the same time, through forms such as order-based training and co-construction of industrial colleges, the integration of production and education provides students with stable employment channels. Enterprises lock in talents in advance, and students can take up posts immediately after graduation, realizing the seamless connection of “employment upon graduation.”

2.3. Serving the regional economy: Promoting the development of the local new energy industry

By accurately connecting local resource endowments and industrial foundations, the new energy industry can not only effectively utilize local clean energy such as wind and solar energy, reduce dependence on traditional fossil energy, but also drive the coordinated development of upstream and downstream industrial chains, forming

an industrial cluster effect. This can not only create a large number of employment opportunities for the local area, improve residents' income levels, but also attract external investment and enhance the endogenous growth momentum of the local economy. At the same time, the development of the new energy industry helps optimize the local energy structure, improve energy utilization efficiency, and reduce carbon emissions, which is of great significance for achieving the goal of green and low-carbon development. Through the combination of policy guidance and market mechanisms, the research, development and application of new energy technologies can be accelerated, promoting industrial innovation and upgrading, enabling the local area to take the lead in the new energy field and form competitive advantages ^[5].

3. Problems existing in the cultivation of new energy professionals

3.1. The curriculum system lags behind technological iteration

The current lag of the new energy professional curriculum behind technological iteration is mainly reflected in three aspects: the disconnection between curriculum content and cutting-edge industrial technologies, the mismatch between the technical update cycle and the rhythm of curriculum adjustment, and the lack of courses in emerging technical fields. Firstly, the update speed of course content may lag behind the development of industrial technologies. For example, although the efficiency of perovskite batteries has exceeded 30% and entered the pilot-scale test phase, most colleges and universities still focus on the principle of crystalline silicon batteries, lacking core technical courses such as perovskite material synthesis, interface engineering, and large-area preparation. This leads to a serious mismatch between students' knowledge structure and industrial needs. Secondly, there is a contradiction between the technical iteration cycle and the curriculum adjustment mechanism. The technical update cycle in the new energy field has been shortened to 1–2 years, while curriculum adjustments in colleges and universities usually take 3–5 years. This time gap makes the technologies learned by students obsolete before they graduate ^[6].

3.2. Insufficient faculty and practical training resources

In the current cultivation of new energy professionals, the problem of insufficient faculty and practical training resources is particularly prominent. The main reason is the imbalance in the proportion of “double-qualified” teachers with industrial experience. Many teachers have been away from front-line production for a long time and lack cognition of practical engineering issues such as perovskite battery coating processes and hydrogen energy storage and transportation system debugging, which leads to a serious disconnection between theoretical teaching and industrial needs ^[7].

3.3. Insufficient depth of integration of industry and education

At the practical level, although vocational colleges generally have established school-enterprise cooperation mechanisms, the forms of cooperation mostly remain in shallow interactions such as order-based class training and lectures by enterprise experts, lacking in-depth collaboration around the entire industrial chain. For example, the matching degree between professional settings and the needs of regional leading industries is not high, and some colleges and universities still have the phenomenon of “running schools behind closed doors”, failing to timely adjust the curriculum system according to the digital and intelligent transformation of industries, resulting in the disconnection between students' knowledge and cutting-edge technologies in the industry. At the resource integration level, the construction of industry-education integration platforms lags behind. The number of

carriers, such as school-enterprise co-built laboratories and industrial colleges, is limited, and there is the problem of “valuing listing over operation”. The enthusiasm of enterprises to participate in vocational education has not been fully stimulated, and there is a lack of supporting policies support such as tax incentives and financial subsidies, leading to slow progress in projects such as the construction of internship and training bases and the joint training of technical and skilled talents^[8].

3.4. Insufficient interdisciplinary capabilities

Affected by traditional educational concepts, many colleges and universities still follow the traditional subject-based teaching model. The professional curriculum setup shows obvious “barrier” characteristics, and the knowledge systems of different disciplines lack organic connection, making it difficult for students to form systematic problem-solving thinking^[9].

At the practical teaching level, interdisciplinary project design is seriously lacking. Practical training tasks mostly focus on a single technical link. For example, photovoltaic laboratories only conduct cell efficiency tests, but do not involve system-level issues such as component packaging processes and inverter control strategies, so students cannot master the full-link design methods of wind-solar-storage integrated systems. In addition, emerging technologies such as digital twins and AI algorithms have not been integrated into traditional experimental courses. For example, in wind farm operation and maintenance, students lack experience in using digital twin technology for virtual debugging, making it difficult to meet the needs of fault prediction and intelligent decision-making in real scenarios^[10].

4. Talent cultivation strategies for new energy majors under the background of industry-education integration

4.1. Optimizing the curriculum system and teaching content

Under the background of industry-education integration, optimizing the curriculum system and teaching content of new energy majors is crucial for cultivating talents who can meet the needs of the industry. To this end, schools should first closely focus on the development trends and technical needs of the new energy industry to build a scientific and reasonable curriculum system. This includes setting up basic theoretical courses on new energy, such as the principles of solar energy, wind energy, hydropower, etc., to lay a solid theoretical foundation for students. At the same time, schools should further strengthen the setting of professional technical courses, such as new energy conversion and storage technology, to help students master new technologies and methods in the field of new energy^[11].

The new energy field involves multiple disciplines such as physics, chemistry, materials, and electronics. Schools can cultivate students' comprehensive literacy and innovative ability by setting up interdisciplinary courses. They can also invite enterprise experts to participate in curriculum development and teaching, integrate the enterprise's actual needs and cases into teaching content, so that students can better understand the actual situation of the industry, improve the pertinence and practicality of learning, and cultivate new energy professionals who have both a solid theoretical foundation, rich practical experience, and innovative ability.

4.2. Strengthening the practical teaching links

Practical teaching can enable students to closely combine theoretical knowledge with practical operations, and improve their professional skills and innovative ability. To achieve this, schools should strengthen the

construction of on - campus training bases, equip them with advanced and complete new energy experimental equipment and instruments, simulate real new energy production and application scenarios, provide students with sufficient practical opportunities, and let them deepen their understanding of theoretical knowledge and skillfully master the operation process of new energy technology in practice^[12].

In addition to on-campus training bases, a good school-enterprise cooperation relationship is also an important measure to improve the effect of practical teaching. Schools need to establish long-term and stable cooperative relations with new energy enterprises, and arrange students to practice in different positions of enterprises according to the needs of enterprises and the professional characteristics of students. During the internship, students can directly participate in the actual projects of enterprises, understand the production process, technical standards and management norms of the new energy industry, and accumulate valuable work experience^[13].

4.3. Promoting the construction of teaching staff

Teachers are the foundation of teaching work. The technology of the new energy industry is updated rapidly, which puts forward high requirements for teachers' professional quality and practical ability. Therefore, schools must take multiple measures to strengthen the construction of teaching staff. In this process, introducing and cultivating "double-qualified" teachers is the key. On the one hand, schools should actively introduce professionals with rich practical experience and profound theoretical knowledge from new energy enterprises and scientific research institutions to enrich the teaching staff. They can bring the latest industry technologies and actual cases to the school, making the teaching content more in line with the needs of the industry. On the other hand, encourage existing teachers to participate in various professional training and academic exchange activities, constantly update their knowledge structure, and improve their professional level. At the same time, arrange teachers to take temporary posts in enterprises, participate in the research and development of actual projects and the production process, accumulate practical experience, improve the ability of practical teaching, and truly become "double-qualified" teachers who can not only impart theoretical knowledge but also guide students' practice^[14].

In addition, schools should establish long-term and stable cooperative relations with enterprises and formulate detailed plans for teachers' temporary posts. During their temporary posts, teachers go deep into the front line of enterprise production, understand the development trend of the industry and the dynamics of technological innovation, and bring the actual problems of enterprises back to the classroom to enrich the teaching content. In addition, enterprise technical backbones and experts can be invited to the school to teach part-time and serve as practical tutors for students. Their rich practical experience and industry insights can broaden students' horizons and stimulate their interest in learning^[15].

5. Conclusion

In summary, amid the wave of the "dual carbon" goals and the transformation of the energy industry, the integration of industry and education has become an inevitable path for cultivating professionals in the new energy sector. The proposal of the concept of industry-education integration has brought a new reform direction to the current training of new energy professionals. To this end, colleges and universities should start by optimizing the curriculum system and teaching content, strengthening practical teaching links, and promoting the construction of teaching staff. They should break down the barriers of traditional education, build a bridge for

in-depth integration of education and industry, and through the organic connection of the education chain, talent chain, with the industrial chain and innovation chain, cultivate more high-quality talents who meet the needs of the times for the new energy industry. This will help China seize the initiative in the global energy transformation and realize the coordinated development of economic and social green development and the “dual carbon” goals.

Funding

Special Fund for the Training and Assistance Program for Young Teachers in Shanghai Universities, Shanghai Municipal Education Commission; Shanghai Municipal Key Course Project, “Project of Building First-Class Courses at University Level of University of Shanghai for Science and Technology” (Project No.: YLKC202309)

Disclosure statement

The author declares no conflict of interest.

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Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Application Strategies of “Artificial Intelligence + Mass Entrepreneurship and Innovation Education” in the International Sphere

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Abstract: With the continuous development of science and technology, artificial intelligence has become one of the core drivers of the development in the current era. Against the background of deepening internationalization and opening-up, higher vocational colleges should focus on promoting “artificial intelligence + innovation and entrepreneurship education”, make use of international transaction resources, learn from the excellent teaching experience of developed countries, promote the transformation of achievements in cultivating students’ innovation and entrepreneurship capabilities, and alleviate the employment difficulties of higher vocational students. Based on this, this paper studies the application strategies of “artificial intelligence + innovation and entrepreneurship education” in the international field, expounds the relationship between artificial intelligence and innovation and entrepreneurship education, analyzes the existing problems, and puts forward corresponding application strategies, aiming to promote the sound development of “artificial intelligence + innovation and entrepreneurship education” and cultivate innovative and entrepreneurial talents needed by the times.

Keywords: International field; Artificial intelligence; Innovation and entrepreneurship education; Application strategies; Higher vocational colleges

Online publication: October 17, 2025

1. Introduction

The rise of artificial intelligence technology has brought unprecedented opportunities and challenges to innovation and entrepreneurship education, driving education towards informatization and intellectualization. Against the backdrop of educational internationalization, higher vocational colleges should rely on artificial intelligence technology to improve innovation and entrepreneurship education, seize the favorable opportunities of internationalization, break the limitations of traditional education, enhance the quality of innovation and entrepreneurship education, and bring students a richer and more personalized learning experience. This paper starts from and attaches great significance to the in-depth study of the integrated development strategy of

“artificial intelligence + innovation and entrepreneurship education”, to give better play to the advantages of the combination of the two and cultivate high-quality talents with an international vision and innovative ability.

2. The relationship between artificial intelligence and innovation and entrepreneurship education

2.1. Technology empowers educational reform

As a cutting-edge technology, artificial intelligence is comprehensively driving profound changes in the field of education, bringing new development opportunities for the reform of innovation and entrepreneurship education. With the help of intelligent teaching platforms, teachers can integrate diverse multimedia resources such as virtual simulation experiments and intelligent interactive courseware into the teaching process, making course content more vivid, intuitive, and easy to understand ^[1]. Through in-depth mining and analysis of educational big data, artificial intelligence can accurately grasp educational trends, assist educational managers in formulating more scientific and reasonable policies and plans, optimize the allocation of educational resources, and promote the overall upgrading of the education system.

2.2. Technology facilitates students’ personalized development

Every student is a unique individual with different learning styles, interests, and knowledge bases. The involvement of artificial intelligence technology provides strong support for realizing personalized education. In terms of teaching models, it breaks the traditional single and fixed teaching format. By analyzing students’ learning behaviors and characteristics, it can accurately push personalized learning resources to improve teaching effectiveness ^[2]. The system can customize personalized learning paths for students and recommend suitable learning materials, such as personalized reading materials and extended exercises. This personalized learning model fully respects students’ individual differences, stimulates their learning interest and potential, and promotes their all-around development ^[3].

2.3. Collaborative development and mutual promotion

Innovation and entrepreneurship education aims to cultivate students’ innovative thinking, entrepreneurial awareness, and practical abilities, while artificial intelligence technology provides it with powerful technical tools and rich application scenarios. The integration of artificial intelligence enables students to access the most cutting-edge technical knowledge, analyze market demands, and inspire innovative ideas ^[4]. The practice of innovation and entrepreneurship education also provides a testing ground for the application and development of artificial intelligence technology. In their entrepreneurial projects, students continuously explore innovative applications of artificial intelligence in different industries, promoting the iterative upgrading of technology. The two promote each other, forming a positive cycle, and jointly contributing to the cultivation of innovative talents who meet the needs of the times ^[5].

3. Existing dilemmas of “Artificial Intelligence + Innovation and Entrepreneurship Education” in the international field

3.1. Inadequate construction of curriculum systems

Currently, higher vocational colleges have started relatively late in innovation and entrepreneurship education,

with a shallow understanding of its educational concepts. They often rigidly introduce traditional educational concepts into innovation and entrepreneurship teaching, making it difficult to effectively exert their due value and apply international cutting-edge research results to curriculum construction. Artificial intelligence technology iterates rapidly, but most courses fail to keep up with frontier knowledge and application cases in a timely manner, resulting in a disconnect between what students learn and the actual needs of the industry. Part of innovation and entrepreneurship education focuses on theoretical teaching, lacking the design of deeply integrating artificial intelligence technology into entrepreneurial practice links, making it difficult for students to practically master the skills of using artificial intelligence for innovation and entrepreneurship in courses. Different courses operate independently, lacking an organic connection, and fail to form a complete knowledge chain from basic theories to practical applications.

3.2. Insufficient development of international faculty

An international faculty is a key force in promoting the development of “Artificial Intelligence + Innovation and Entrepreneurship Education,” but there are obvious shortcomings in this aspect at present. “Artificial Intelligence + Innovation and Entrepreneurship Education” requires teachers to be proficient in artificial intelligence technology, familiar with the concepts and methods of innovation and entrepreneurship education, and have an international perspective to understand the business environments and educational models of different countries. However, in reality, most teachers only have expertise in a single disciplinary field, which makes it difficult to meet teaching needs. Moreover, international educational concepts and technologies are constantly updated, but due to various constraints, many teachers cannot obtain international cutting-edge information in a timely manner, making it difficult to integrate the latest international educational concepts and methods into the teaching process, which hinders the improvement of educational quality.

3.3. Need for strengthening international innovation and entrepreneurship platforms

International innovation and entrepreneurship platforms play an important role in promoting students’ practice, communication, and resource connection, but their construction is still incomplete, with many problems. For example, their functions are single and services are inadequate. Some platforms only provide simple project display and communication functions, lacking guidance and services for the entire process of students’ entrepreneurial projects. Schools have insufficient close cooperation with internationally renowned enterprises and research institutions, failing to establish long-term and stable international cooperative relations. This cannot provide students with rich international internship and exchange programs, as well as opportunities to participate in international innovation and entrepreneurship competitions, limiting the expansion of students’ international perspectives.

4. Application strategies of “Artificial Intelligence + Innovation and Entrepreneurship Education” in the international field

4.1. Building a collaborative platform for artificial intelligence and innovation, and entrepreneurship education

In the international context, higher vocational colleges should establish a modern educational philosophy, focus on improving the quality of talent cultivation, integrate the characteristics of international talent development, and build a collaborative platform for artificial intelligence and innovation, and entrepreneurship education.

First, build a collaborative education platform. Higher vocational colleges should proactively expand off-campus practice bases and promote the establishment of close collaborative networks with multiple companies and research institutions. For example, in art and design disciplines, colleges can collaborate with the art and design industry, allowing students to participate in practical projects. By applying artificial intelligence technology to creative design products, students' innovation and entrepreneurship capabilities can be enhanced ^[6]. Collaborations with research institutes can help students stay updated on the latest research trends, enabling them to use artificial intelligence to drive the development of innovative enterprises ^[7].

Second, construct an innovation and entrepreneurship education ecosystem with China-ASEAN international talent characteristics. Schools should leverage the achievements of China-ASEAN exchanges, collaborate with industry enterprises to compile characteristic entrepreneurship textbooks, jointly design curriculum systems, and optimize teaching practices. For instance, establishing effective collaboration mechanisms requires schools to pursue efficiency and organic coordination, with regular communication and collaboration mechanisms with relevant stakeholders ^[8]. Specifically, enterprises can provide practical work environments and project resources, schools can focus on talent cultivation and theoretical innovation, and research institutions can lead scientific and technological research. Through information sharing and joint project research, resources can be efficiently organized, and effective mechanisms for talent development and technological innovation can be established. In terms of support mechanisms, governments should lay a solid foundation for the platform's sustainable development. Policies should encourage schools and enterprises to participate in innovative education, such as offering tax reductions, exemptions, or subsidies, to boost their enthusiasm ^[9].

4.2. Improving curriculum systems for international fields

With deepening international exchanges, higher vocational colleges should refine their curriculum systems to meet the demand for innovative and entrepreneurial talents across industries. First, ensure the freshness of the course content. Keep pace with international advancements in artificial intelligence technology and industry trends, integrating new research breakthroughs and practical application cases into courses. For example, introducing the widely recognized achievements of generative artificial intelligence in art, writing, and other fields in recent years can expose students to cutting-edge technological information and enhance their industry sensitivity ^[10].

Second, build a systematic and coherent curriculum structure. Higher vocational colleges should offer foundational theoretical courses to lay the groundwork for AI and innovation, such as Introduction to Artificial Intelligence and Introduction to Innovation Principles. Specialized courses should focus on applying AI to drive industry innovation and entrepreneurship, such as Innovative Applications of AI in Finance and AI-Oriented Product Innovation Design ^[11]. Additionally, interdisciplinary elective courses should be added to encourage students to explore other fields, fostering interdisciplinary communication, broadening their horizons, and improving their comprehensive abilities. Third, introduce high-quality overseas teaching materials. To achieve international education goals and meet market needs, deepening international exchanges and cooperation is crucial. This includes co-developing and accrediting courses with world-leading universities and educational institutions, and inviting top foreign teachers to assist in curriculum development and teaching. Schools should also promote online international courses through platforms like MOOCs, enabling students to access high-quality foreign courses easily, improve their learning outcomes, expand their global perspectives, and better respond to international challenges ^[12].

4.3. Enrich teaching methods for artificial intelligence + innovation and entrepreneurship education

In response to the application needs of artificial intelligence technology, teachers should focus on enriching methods to integrate AI technology into innovation and entrepreneurship education activities, thereby enhancing teaching effectiveness. For example, teachers can adopt project-oriented learning methods and use intelligent technologies to stimulate students' innovative thinking and practical abilities. Taking art design-related courses as an example, teachers can offer an exploratory project titled "Using Artificial Intelligence to Enhance Innovation in Artistic Creation," guiding students to conduct research in groups through collaborative discussions and independent thinking. During the project exploration, group members investigate the application of intelligent technologies in image generation and creative conception, understand the generation logic and application methods of intelligent technologies, use tools such as MidJourney and Stable Diffusion to generate artistic inspiration materials, and analyze their impact on the artistic creation process and style. Group members review relevant literature, conduct group research, and attempt to use intelligent technologies to assist artistic creation, thereby cultivating students' digital literacy. Teachers can use artificial intelligence technology to build intelligent teaching platforms to promote personalized learning. Intelligent platforms can use big data analysis and other technologies to accurately grasp students' learning situations and push personalized learning resources based on their actual conditions ^[13]. For instance, in the teaching of programming-related innovation and entrepreneurship courses, intelligent platforms can record data such as the time spent writing code, types of errors, and problem-solving duration to determine students' mastery of different programming knowledge points. For students who struggle with algorithm implementation, the platform can push algorithm explanation videos and code exercises; for students who progress quickly, it can provide challenging project practice tasks and extended materials to help them achieve further development. In addition, schools can organize entrepreneurship competitions, such as business plan writing contests, requiring students to write business plans based on their professional fields, covering market analysis and business model elaboration, to cultivate students' project planning abilities and lay a solid foundation for their future entrepreneurship.

4.4. Vigorously cultivating an international teaching team

To realize international innovation and entrepreneurship education, higher vocational colleges should ensure the diversity of their teaching staff structure, strengthen cooperation and exchanges between institutions in different countries, promote a certain degree of international mobility of the teaching team, and vigorously cultivate an international teaching team. First, increase training efforts for faculty and staff to broaden their international perspectives. Schools should allocate special funds to support teachers in participating in international education forums and AI-integrated innovative education training camps, such as organizing some teachers to participate in activities held by the International Society for Technology in Education (ISTE) to learn about advanced overseas AI education practices and innovative educational concepts. At the same time, encourage teachers from different fields in the school, such as those specializing in AI technology, innovation and entrepreneurship, management, and art design, to conduct joint teaching research, explore interdisciplinary courses together, and actively apply for participation in joint projects. Schools should encourage teachers to break down the barriers between departments and majors, attend relevant courses in other disciplines, focus on obtaining interdisciplinary qualifications, improve their teaching skills and research capabilities in interdisciplinary fields, and guide students to develop innovative ideas of multidisciplinary integration ^[14].

Second, establish an international exchange and cooperation mechanism for teachers. Schools should

strengthen close cooperation with foreign prestigious universities and enterprises, regularly send teachers to study abroad, conduct research, or participate in internships; invite top overseas talents to offer open courses and training programs on campus, promoting in-depth understanding and cooperation between local teachers and foreign experts. This will enable teachers to engage in broader knowledge sharing and thinking innovation, creating a strong atmosphere of international education and teaching on campus. Third, introduce more high-level overseas talents. Schools should adopt active talent introduction measures to attract foreign teachers and scholars with AI knowledge and innovation and entrepreneurship experience from world-class universities and institutions, such as recruiting foreign teachers or visiting professors. They should provide a favorable working environment and start-up funds for scientific research to create a good atmosphere for teaching and research, striving to retain these talents or invite them to teach, thereby introducing high-quality foreign teaching models and the latest research results to the campus.

4.5. Connecting with the public service system for student entrepreneurship

In the process of promoting innovation and entrepreneurship education, schools should focus on meeting students' actual entrepreneurial needs, build a sound public service system, and create a favorable entrepreneurial environment for them. First, provide policy guarantees. In terms of finance, the government should set up special support funds to provide financial support for student entrepreneurial projects. For example, for entrepreneurial teams developing artificial intelligence educational assistance products, government departments can offer research and development subsidies to help them overcome technical difficulties and promote product implementation. In terms of financing, government departments should encourage financial institutions to innovate financial products and services, and open green channels for student entrepreneurial projects. For instance, launch low-interest loans for artificial intelligence entrepreneurial projects, lower loan thresholds, simplify approval procedures, and alleviate the financial shortage dilemma of college students' entrepreneurship. Government departments should guide various regions to establish public service platforms for college students' entrepreneurship, break down barriers between institutions of higher learning and localities, promote effective integration of education and industry, and guide promising entrepreneurial projects within five years of graduation to join the public service platform^[15].

Second, provide education and training support. Higher vocational colleges, enterprises, and social institutions should provide education and training support for student entrepreneurship and offer systematic entrepreneurship courses. Among them, higher vocational colleges should give full play to their advantages in theoretical teaching, explaining basic entrepreneurial theories, business plan writing, and other knowledge; enterprises should share practical industry experience, such as application cases of artificial intelligence in different industries and market promotion strategies; social training institutions can carry out special skills training covering aspects from technical research and development direction control, business model optimization to market risk response, and provide one-on-one guidance to help students avoid detours.

4.6. Integrating ideological and political education into innovation and entrepreneurship education

Ideological and political education can guide students to establish correct employment and career views, enabling them to have clearer goals and firmer beliefs when facing employment choices. In innovation and entrepreneurship education, higher vocational colleges should focus on integrating ideological and political education into "artificial intelligence + innovation and entrepreneurship education" and meet the requirements of

international education. On the one hand, teachers should use artificial intelligence technology to deeply explore ideological and political elements in innovation and entrepreneurship education. Through big data analysis, they can accurately grasp students' ideological trends in innovation and entrepreneurship practice, such as their value orientation in idea conception and project promotion, to targetedly integrate ideological and political content such as social responsibility, guide students to establish correct values of innovation and entrepreneurship, and ensure that students do not forget their social responsibilities when using artificial intelligence for market analysis, product design, and other activities.

On the other hand, build an innovation and entrepreneurship ideological and political education platform based on artificial intelligence. Teachers should integrate high-quality ideological and political education resources, use intelligent recommendation systems to push personalized innovation and entrepreneurship ideological and political learning materials to students, such as social responsibility cases of excellent domestic and foreign entrepreneurial teams and patriotic stories containing the spirit of innovation; with the help of virtual simulation technology, create immersive ideological and political practice scenarios, such as simulating situations of resolving cultural conflicts in international business cooperation, so that students can deepen their understanding of ideological and political concepts in practice, improve their abilities and qualities in carrying out innovation and entrepreneurship activities in complex international environments, and promote the in-depth integration of ideological and political education and innovation and entrepreneurship education under the empowerment of technology.

5. Conclusion

To sum up, from the perspective of educational internationalization, higher vocational colleges should focus on implementing the development concept of the new era, learn more from the beneficial experiences of domestic and foreign institutions of higher education in carrying out innovation and entrepreneurship education, promote cooperation with various countries and regions, and deepen international cooperation and exchanges in innovation and entrepreneurship education. In the actual teaching process, schools should focus on building a collaborative platform for artificial intelligence and innovation and entrepreneurship education, improve the curriculum system oriented to the international field, enrich the teaching methods of “artificial intelligence + innovation and entrepreneurship education”, vigorously cultivate an international teaching team, connect with the public service system for college students' entrepreneurship, integrate local resources to promote the integration of industry and education, and enhance the quality of talent training. With the continuous progress of artificial intelligence technology and the deepening of foreign exchanges, higher vocational colleges should constantly improve and optimize the innovation and entrepreneurship education model, and play a more important role on the international education stage.

Disclosure statement

The author declares no conflict of interest.

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A Study on the Paths of Integrating Excellent Traditional Chinese Culture into Secondary Vocational English Teaching

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Abstract: Traditional culture is a culture formed by the continuous evolution of human civilization, which can reflect the style and concepts of a nation. Each nation has its own traditional culture. In the teaching of vocational English courses, teachers should pay attention to integrating excellent traditional Chinese cultural content in order to enhance the richness and effectiveness of teaching and expand the depth of teaching. Based on this, this article conducts research on the path of integrating excellent traditional Chinese culture with vocational English teaching, elaborates on the important value of the integration of the two, and proposes corresponding implementation strategies, aiming to provide feasible strategies for inheriting and disseminating excellent traditional Chinese culture in vocational English teaching, and help students enhance cultural confidence and comprehensive literacy in English learning.

Keywords: Excellent traditional Chinese culture; Vocational English; Integration; Route

Online publication: October 17, 2025

1. Introduction

In the context of accelerating globalization, cross-cultural exchanges have become increasingly frequent. Vocational English teaching in secondary vocational schools not only undertakes the task of cultivating students' language application abilities, but also shoulders the mission of spreading excellent traditional Chinese culture and enhancing students' cultural confidence and international communication skills. Exploring the integration path of excellent traditional Chinese culture and vocational English teaching in secondary vocational schools has important practical significance. This study aims to explore the value of integrating the two, construct an effective integration path, so that vocational English teaching in secondary vocational schools can become an important carrier for inheriting and promoting excellent traditional Chinese culture and improving students' comprehensive literacy, and helping students tell Chinese stories well on the international stage.

2. The significance of integrating excellent traditional Chinese culture into secondary vocational English teaching

2.1. Conducive to cultivating students' cross-cultural awareness

Integrating excellent traditional Chinese culture into English teaching can guide students to use English as a tool to gain an in-depth understanding of traditional Chinese festivals, classic literature, philosophical thoughts, and other content ^[1]. In the process of comparing Chinese and Western cultural differences, students can not only broaden their cultural horizons but also establish a two-way cultural cognitive system. This helps cultivate a more comprehensive and in-depth cross-cultural awareness, avoiding the phenomenon of “cultural aphasia” in cross-cultural communication.

2.2. Conducive to enhancing students' international communication competence

When students master the ability to express excellent traditional Chinese culture in English, they can more confidently share Chinese stories and convey the Chinese voice in international exchanges ^[2]. For example, by learning to introduce cultural contents such as “the 24 Solar Terms” and “Traditional Chinese Medicine (TCM) health preservation” in English, students can break through the dual barriers of language and culture. This enhances the richness and depth of topics when communicating with people from different cultural backgrounds, improves cross-cultural communication skills, and enables English to truly become an effective tool for spreading Chinese culture and conducting international exchanges.

2.3. Conducive to implementing the fundamental task of “Establishing Morality and Cultivating People”

Excellent traditional Chinese culture contains rich moral norms, values, and national spirits, making it a valuable resource for implementing the fundamental task of “establishing morality and cultivating people.” Integrating traditional culture into English teaching allows students to imperceptibly receive the influence of traditional culture while learning the language, thereby enhancing their national pride and cultural identity ^[3]. For instance, when learning the English expressions of traditional moral concepts such as “benevolence, righteousness, propriety, wisdom, and faithfulness,” students not only understand their connotations but also practice them in daily life. This achieves the organic unity of knowledge acquisition and moral cultivation, promoting the all-round development of students.

3. Approaches to integrating excellent traditional Chinese culture into vocational English teaching

3.1. Integrating traditional cultural resources to appreciate the charm of traditional culture

Excellent traditional Chinese culture embodies profound wisdom and values. It broadens students' horizons in terms of knowledge and enhances their self-awareness through a sense of cultural pride. In designing teaching content, teachers can incorporate classic Chinese poetry, ancient fables, and traditional festivals, allowing students to experience the charm of Chinese culture while learning English ^[4]. For instance, schools can launch an activity titled “English in Poetry and Painting,” creating a bridge to the allure of traditional Chinese culture. In this course, teachers select works by Chinese literati such as Li Bai, Du Fu, and Su Dongpo and integrate them into English teaching activities. Take Li Bai's poem Quiet Night Thoughts as an example: Teachers can

first guide students to appreciate the aesthetic beauty of the Chinese characters, then introduce its English translation—"Before my bed a pool of light, I wonder if it's frost aground"—and compare the two versions. This helps students understand differences in linguistic structure and descriptive styles between Chinese and English. Linguistically, students learn new vocabulary like "frost" and "wonder," and master sentence patterns such as "Before..." and "I wonder if..."^[5]. Culturally, by exploring the poem's background and the poet's style, students gain insight into the emotional world, values, and aesthetic tastes of ancient Chinese literati, deepening their understanding of traditional Chinese emphasis on hometown and family ties^[6]. Beyond Tang and Song poetry, learning can extend to classic works like *The Book of Songs*. Teachers can use topics such as ancient marriage customs and poetic metrics to help students consolidate English skills, foster a closer connection with excellent traditional Chinese civilization, gradually appreciate its unique charm, and enhance their cultural appreciation and cross-cultural understanding.

3.2. Designing characteristic teaching activities to enrich traditional cultural experiences

Integrating traditional culture into English teaching effectively improves students' English proficiency and deepens their understanding of the charm of excellent culture. Teachers can design characteristic teaching activities based on traditional cultural content to enrich students' learning experiences. Take classic stories like *Pao Ding Dismembers an Ox* as an example. Teachers can skillfully incorporate them into teaching by narrating the story, explaining its philosophical connotations, and enriching students' language learning experiences^[7]. The teaching goal is to ensure students grasp the story thoroughly and can express its philosophical meaning in English. Teachers can use vivid English descriptions, such as "Once upon a time, there was a cook named Pao Ding who was extremely skilled at butchering oxen," to guide students through the story. Encouraging students to express their understanding of the philosophy in English prompts them to reflect on Zhuangzi's ideas of "following nature" and "mastery through practice," while honing their language organization and logical thinking skills. Through English discussions, students also improve their oral proficiency and learning confidence^[8]. Comparing these ideas with Western philosophical views on craftsmanship and practice helps students appreciate the uniqueness of Chinese philosophy and broaden their cultural horizons. Additionally, teachers can include performance segments to facilitate knowledge internalization. For example, students may present their understanding through English poetry, creating verses that reflect their insights through rhythm and cadence. They could also perform short skits, role-playing characters like Pao Ding and Lord Wenhui, and vividly reenact scenes, such as Pao Ding explaining his butchering philosophy to Lord Wenhui, through dialogue and performance^[9]. These activities allow students to move beyond textbook knowledge, immersing themselves in English learning within the context of traditional cultural stories, enriching their language experiences, and deeply appreciating the charm of excellent traditional Chinese culture.

3.3. Innovate classroom teaching methods and create an atmosphere for traditional culture teaching

In the process of integrated teaching, teachers should focus on innovating teaching methods, introducing diversified teaching means, and creating a learning atmosphere for traditional culture. Taking Unit 6 "Not Just Tasty!" in secondary vocational English as an example, teachers can design the following teaching activities.

First, situational teaching. Teachers create teaching situations based on the teaching content, allowing students to immerse themselves in the charm of Chinese food culture. For example, design a scenario of a traditional Chinese food culture festival, simulating a lively food street scene. On the stalls, there are models

of foods with English labels such as dumplings, zongzi, and mooncakes. Students are guided to play the roles of stall owners and customers, communicating in English about the characteristics and production techniques of the foods, such as “These dumplings are made by hand. They are filled with delicious meat and vegetables”^[10]. Through such dialogues and interactions, students can effectively practice their oral English expression, experience the charm of Chinese food culture firsthand, and understand the cultural meanings, such as reunion and blessing, behind the food.

Second, comparative analysis teaching^[11]. Teachers guide students to compare Chinese and Western food cultures, analyzing from ingredient selection, cooking methods, to table manners, so as to deepen students’ understanding of different food cultures. For example, in terms of food preparation, Chinese cuisine emphasizes the diversity of ingredients and the combination of meat and vegetables; Western cuisine, on the other hand, emphasizes the original flavor of ingredients, and the cooking methods are relatively simple. In terms of table manners, China stresses the order of seniority and juniority, while the West emphasizes ladies first. In the process of comparison, students can feel the uniqueness of different cuisines and enhance their cross-cultural communication awareness.

Third, multimedia teaching. Teachers can use multimedia resources to play Chinese food documentaries, such as clips from *A Bite of China*, to showcase the characteristic foods of various regions. With rich images and vivid explanations, it can attract students’ attention. Teachers can also use animations to demonstrate the production process of traditional foods and play English songs such as *An Apple a Day*, combining food with English learning, creating an interesting atmosphere for exploring Chinese food culture, and stimulating students’ enthusiasm for English learning^[12].

3.4. Optimize the teaching evaluation system and reflect on the effectiveness of traditional culture teaching

Teaching evaluation can reflect students’ cognition and learning outcomes of the traditional culture in their English learning. Teachers should focus on optimizing the construction of the teaching evaluation system and comprehensively assess students’ mastery of English knowledge and traditional culture. Therefore, teachers need to introduce diversified evaluation methods.

First, project assignments. Teachers can assign the task of “creating a promotional manual for Chinese traditional festivals in English,” requiring students to independently search for materials, understand the origin, customs and other contents of the festivals, and present them in English with both pictures and texts. During the completion of the assignment, teachers evaluate students on the completeness of information collection, the accuracy of English expression, and the depth of understanding of cultural connotations^[13].

Second, speech presentations. Teachers can organize speech presentation activities to assess students’ oral expression ability and cultivate their learning confidence. For example, students can be asked to give a speech on the topic of “Traditional Chinese Crafts in My Eyes”, expounding on the characteristics and values of crafts such as paper-cutting and embroidery. During the speech, teachers evaluate students on the fluency of their language and the standardness of their pronunciation, pay attention to students’ interpretation of the cultural essence of traditional crafts, and whether they can vividly present them using appropriate English vocabulary, so as to improve students’ ability to spread traditional culture in English^[14].

Third, field trips. Teachers can organize students to visit local historical and cultural museums, folk villages, etc., so that students can experience the atmosphere of traditional culture on the spot and obtain first-hand materials. Teachers can evaluate students’ ability to intuitively experience traditional culture and transform their

understanding based on their performance in observation records, problem thinking, and follow-up summary reports during the visit, which is an benefit that traditional evaluation methods are difficult to achieve^[15].

Fourth, personalized evaluation. Different students have different interests in traditional culture; some are fond of classical literature, while others are passionate about traditional art. Teachers should fully consider students' individual needs and development directions, and provide personalized evaluation standards and tasks according to their interests. For example, for students who love classical literature, assign them the task of rewriting classic poems in English and analyzing cultural images; for students who are passionate about traditional art, ask them to introduce traditional painting styles and representative works in English. Through personalized methods, students' internal motivation for learning can be stimulated, and the evaluation system can better help students' personalized development.

4. Conclusion

In summary, integrating excellent traditional Chinese culture with vocational English teaching is not only a requirement of the times but also an important measure to cultivate high-quality international talents. In the teaching process, teachers should focus on integrating resources, designing characteristic activities, innovating teaching methods, and optimizing evaluation systems, to effectively incorporate traditional culture into teaching. This will not only improve students' English language proficiency but also enhance their cross-cultural awareness. Teaching reform is an ongoing process. English teachers should deepen the exploration and application of traditional culture, pay attention to students' personalized development needs, and promote the better dissemination of excellent traditional Chinese culture in international exchanges.

Disclosure statement

The author declares no conflict of interest.

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Exploration of the Path for Implementing Curriculum Ideological and Political Education in College Accounting Courses

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Abstract: Under the requirements of educational reform in the new era and the fundamental task of fostering virtue through education, the construction of curriculum ideological and political education in college accounting courses has become an important part of cultivating high-quality accounting talents. However, currently, there are problems in college accounting courses, such as insufficient integration of ideological and political education and the need to improve teachers' capabilities. Based on this background, this paper deeply analyzes the current situation of implementing curriculum ideological and political education in college accounting courses. Specifically, it proposes specific paths, including strengthening the construction of the teaching staff to improve teachers' teaching ability in curriculum ideological and political education, optimizing teaching content to achieve in-depth integration of ideological and political elements and professional knowledge, innovating teaching methods to enhance the teaching effect of curriculum ideological and political education, and perfecting the evaluation system to scientifically measure the teaching effectiveness. This paper aims to promote the organic combination of accounting professional knowledge and ideological and political education, provide theoretical and practical references for cultivating accounting talents with both professional qualities and good professional ethics, the concept of the rule of law, and a sense of social responsibility, as well as for improving the teaching quality of curriculum ideological and political education in college accounting courses.

Keywords: College accounting courses; Curriculum ideological and political education; Teaching reform; Talent cultivation

Online publication: October 17, 2025

1. Introduction

With the rapid development of China's economy and the acceleration of the process of global economic integration, society's demand for accounting talents is no longer limited to professional skills alone. Instead, more emphasis is placed on their professional ethics, the concept of the rule of law, integrity awareness, and social responsibility. However, currently, in the teaching of college accounting courses, there is generally a phenomenon

of emphasizing the imparting of professional knowledge while neglecting value guidance. During the teaching process, teachers often focus on explaining professional skills such as accounting methods and the preparation of financial statements, while ignoring the cultivation of students' professional ethics, legal thinking, and feelings of patriotism and a sense of responsibility towards the country and the family. Therefore, deeply implementing curriculum ideological and political education in college accounting courses, deeply integrating ideological and political education with professional knowledge teaching, and cultivating high-quality accounting talents with both ability and moral integrity are not only an inevitable requirement for responding to national education policies, but also a practical need to meet the development needs of the accounting industry and promote the healthy and sustainable development of the accounting industry ^[1].

2. Theoretical basis for implementing curriculum ideological and political education in college accounting courses

2.1. Connotation and core essence of curriculum ideological and political education

Curriculum ideological and political education is not simply the superimposition of courses and ideological and political elements. Instead, it is an innovative concept that emerged with the development of educational reform in the new era. It stems from the reflection on and breakthrough of the traditional ideological and political education model, aiming to break the situation where ideological and political courses and professional courses are taught independently. It fully explores the ideological and political education resources contained in various courses and constructs a comprehensive education system. Its essence lies in building an education pattern involving all staff, the entire process, and all courses. It requires all faculty and staff in schools, whether professional teachers, administrative personnel, or logistics workers, to become participants in ideological and political education. It runs through the entire academic career of students from enrollment to graduation, integrating ideological and political education into various aspects such as classroom teaching, practical activities, and campus culture. It covers all courses offered by universities, enabling each course to play an educational role and achieve the organic unity of knowledge imparting and value guidance ^[2].

In humanities and social science courses, by analyzing historical events and social phenomena, students can be guided to establish correct historical and value views. This model of integrating ideological and political education into all aspects and links of curriculum teaching and reform allows students to subtly receive ideological edification during the process of learning professional knowledge, shape correct worldviews, outlooks on life, and values, and truly implement the fundamental task of fostering virtue through education.

2.2. Theoretical basis for the integration of accounting courses and curriculum ideological and political education

From the perspective of the disciplinary characteristics of accounting, accounting has extremely strong rigor and practicality. Its work results directly affect economic decisions and resource allocation, and do not allow the slightest falsehood or error. This characteristic is naturally consistent with the concepts of seeking truth and being pragmatic, and being honest and trustworthy, emphasized by curriculum's ideological and political education. For example, in the process of preparing financial statements, any tampering with data may lead to serious consequences, which is an excellent starting point for cultivating students' integrity qualities and the concept of the rule of law. In terms of talent cultivation objectives, the accounting industry needs not only professionals proficient in accounting treatment and financial analysis, but also practitioners with a high level of professional

ethics and a strong sense of social responsibility. The values such as dedication and fairness advocated by curriculum ideological and political education are in line with the requirements for cultivating accounting talents. The integrity principles and professional ethics of the accounting industry are essentially deeply consistent with the concepts of “integrity,” “dedication”, and “fairness” in the core socialist values^[3,4]. By integrating curriculum, ideological and political education into accounting courses, students can not only master professional knowledge, but also help them establish correct values, enabling them to adhere to the bottom line in their future career paths and truly become accounting talents with both ability and moral integrity. Thus, it can be seen that the integration of accounting courses and curriculum ideological and political education is not only feasible, but also an inevitable requirement of the development of the times.

3. Analysis of the current situation of implementing curriculum ideological and political education in college accounting courses

3.1. Achievements made

Currently, many universities are actively exploring the integration of curriculum, ideological and political education into accounting courses and have achieved a series of remarkable results^[5]. For example, Shanghai University of Finance and Economics, combined with the characteristics of the accounting major, has developed a characteristic ideological and political case database of “Accounting Integrity and Professional Ethics”. By analyzing classic cases of financial fraud at home and abroad, students are guided to deeply understand the importance of accounting integrity and strengthen their professional ethics. The Central University of Finance and Economics has carried out the theme teaching activity of “The Road of Red Finance,” integrating the red accounting stories during the revolutionary war period into the courses, so that students can inherit the spirit of arduous struggle and cultivate a deep patriotic sentiment while understanding the development process of the major. In addition, Southwest University of Finance and Economics has innovated the teaching mode and organized students to participate in the practical project of “Financial Assistance for Rural Revitalization.” In the process of helping rural areas improve their financial systems, students’ sense of social responsibility and service awareness are cultivated. These practical achievements not only provide rich materials and diverse forms for the teaching of curriculum ideological and political education in accounting courses, but also provide referenceable experiences for other universities to promote the construction of curriculum ideological and political education^[6].

3.2. Existing problems

3.2.1. Teacher level

Some accounting teachers in colleges and universities have misunderstandings about curriculum ideological and political education. They simply equate it with the indoctrination of ideological and political knowledge and fail to truly understand the connotation of integrating curriculum, ideological and political education into professional teaching “silently and imperceptibly.” Due to the lack of systematic training, teachers have insufficient ability to explore the ideological and political elements in accounting courses and find it difficult to accurately identify the combination points between ideological and political education and professional knowledge^[7]. In terms of teaching methods, they mostly adopt the traditional lecture-based approach and are unable to flexibly use teaching methods such as case teaching and situational teaching to naturally integrate ideological and political content into the classroom. As a result, there is a separation between ideological and political education and professional teaching, which not only affects the educational effect of curriculum ideological and political

education but also hinders the coordinated development of students' professional qualities and values.

3.2.2. Teaching content level

Some teachers, when designing courses, do not deeply explore the internal logical connection between accounting professional knowledge and ideological and political elements. Instead, they mechanically insert ideological and political content into the teaching process. For example, when explaining the preparation of accounting entries, they forcefully introduce ideological and political slogans that have little relevance to the content. Or in the course of financial statement analysis, they rigidly add large paragraphs of ideological and political theories, which disrupts the coherence of the explanation of professional knowledge. This rigid way not only fails to enable students to feel the value of ideological and political education but also easily arouses students' resistance. As a result, it is difficult for curriculum ideological and political education to achieve the expected educational effect, and hinders the organic integration of professional teaching and ideological and political education.

3.2.3. Teaching method level

Most teachers still rely on the traditional lecture-based teaching method, which mainly focuses on one-way indoctrination, lacks interactivity, and it is difficult to stimulate students' enthusiasm for learning ideological and political content. In case teaching, the ideological and political cases are outdated and lack pertinence. In the practical teaching link, ideological and political elements have not been fully integrated. This single teaching mode makes it difficult to instill curriculum ideological and political education into students, and it is impossible to deeply integrate ideological and political education with professional knowledge, seriously restricting the realization of the educational effect of curriculum ideological and political education.

3.2.4. Evaluation system level

The current evaluation mostly focuses on the degree of students' mastery of professional knowledge, and there is a lack of quantitative standards and diverse evaluation methods for the ideological and political achievements, such as the shaping of students' values and the cultivation of professional ethics. There are also no systematic evaluation indicators for teachers' curriculum ideological and political teaching design and implementation process, making it difficult to determine whether the integration of ideological and political elements is effective^[8]. Due to the lack of a scientific evaluation system, it is impossible to accurately locate teaching problems, which is not conducive to optimizing the teaching of curriculum ideological and political education and also makes it difficult to ensure the realization of the educational objectives of curriculum ideological and political education in accounting courses.

4. Exploration of the path for implementing curriculum ideological and political education in college accounting courses

4.1. Strengthening the construction of the teaching staff and improving the teaching ability of the curriculum, ideological and political education

First of all, it is necessary to establish a systematic teacher training system and carry out hierarchical and classified special training for accounting teachers. On the one hand, by inviting ideological and political education experts and experienced teachers of curriculum ideological and political education to give special lectures, interpreting the policy documents of curriculum ideological and political education, and analyzing the

core connotation of curriculum ideological and political education, teachers can deepen their understanding of the educational value of curriculum ideological and political education. On the other hand, setting up practical workshops for curriculum ideological and political education in accounting courses, focusing on the knowledge points of accounting courses, to guide teachers on how to accurately explore ideological and political elements. For example, in the cost accounting course, the thinking of cost control can be extended to the education of the traditional virtue of thrift; in the auditing course, the cultivation of the concept of the rule of law and the sense of responsibility can be integrated in combination with the function of auditing supervision ^[9].

At the same time, it is crucial to build a platform for teachers' teaching seminars and experience exchanges. Schools can regularly organize teaching seminars on curriculum, ideological and political education in accounting courses, encouraging teachers to discuss the difficulties and hot issues in teaching and share successful cases and innovative teaching methods. For instance, some teachers combine the accounting professional ethics norms with typical cases of financial fraud and guide students to think critically in the form of case analysis classes. Through experience sharing and the collision of ideas, teachers can draw on excellent teaching experiences, broaden their thinking in curriculum ideological and political teaching design, and further improve their overall teaching ability, thus promoting the high-quality development of curriculum ideological and political teaching in accounting courses ^[10].

4.2. Optimizing teaching content and achieving in-depth integration of ideological and political elements and professional knowledge

When exploring the ideological and political elements of the curriculum, it is necessary to closely adhere to the essential characteristics of accounting and accurately extract the key points of ideological and political education from the professional knowledge system. For example, when explaining the "Accounting Law" and other contents, the rule of law spirit, fairness principle behind the legal provisions can be combined with the values of honesty and trustworthiness to guide students to understand the important significance of accounting regulations in maintaining the order of the market economy and cultivate their professional ethics of practicing in accordance with the law and adhering to the bottom line. In the financial statement analysis course, by interpreting the corporate social responsibility report and analyzing the financial investment of enterprises in environmental protection, employee rights protection, and other aspects, students can be helped to establish the concept of sustainable development and social responsibility. At the same time, in the cost accounting teaching, taking the cost control strategy as the breakthrough point, the education of the traditional virtues of thrift and arduous struggle can be infiltrated, so that the ideological and political education and professional knowledge are seamlessly connected.

In addition, the update of teaching content should be closely in line with the development trends of the industry and social hot issues ^[11]. For example, in combination with the application of financial robots and intelligent accounting systems in the context of digital transformation, students can be guided to think about the opportunities and challenges in the transformation of the accounting profession, and their innovative consciousness and the concept of lifelong learning can be cultivated. For hot issues such as financial fraud and audit failures, special discussions can be organized so that students can strengthen their integrity awareness and professional ethics in the process of analyzing cases. By integrating cutting-edge industry knowledge and vivid social cases into the classroom, it can not only improve students' professional cognition but also enhance the sense of the times and attraction of curriculum ideological and political education, and achieve the synchronous development of knowledge imparting and value guidance.

4.3. Innovating teaching methods and enhancing the teaching effect of curriculum ideological and political education

In the application of the case teaching method, representative accounting cases can be carefully selected, such as the financial fraud case of Enron Corporation and the event of Luckin Coffee inflating its revenue. Through in-depth analysis of these typical cases, students can be guided to think about the serious consequences of the lack of accounting professional ethics, and their integrity awareness and sense of responsibility can be strengthened. At the same time, positive cases can be introduced to enable students to recognize the importance of adhering to professional ethics for the development of enterprises and individuals and establish correct professional values^[12].

The combination of situational teaching method and group cooperative learning method can enable students to deepen their understanding of the connotation of ideological and political education in practical experience^[13]. For example, simulate the working scenarios of the enterprise's financial department, set tasks such as financial decision-making and tax planning, and require students to complete them in groups. In this process, students can not only use professional knowledge to solve practical problems but also experience the importance of professionalism and team consciousness in team cooperation. Through role-playing, their rigorous and meticulous working attitude and fair and objective professional qualities can be cultivated.

In addition, by using modern information technology to carry out online and offline blended teaching, the limitations of time and space can be broken, and the teaching field of curriculum ideological and political education can be expanded. Online, teachers can use the learning platform to release resources such as ideological and political micro-courses and industry hot topic videos, set discussion topics, and guide students to learn and think independently. In offline classes, interactive teaching activities such as case discussions and situational simulations can be carried out. Through the linkage of online and offline, the organic unity of knowledge transfer and value guidance can be realized, and the teaching effectiveness of curriculum ideological and political education can be comprehensively improved.

4.4. Perfecting the evaluation system and scientifically measuring the teaching effectiveness of curriculum, ideological and political education

In the construction of evaluation indicators, it is necessary to break through the traditional single assessment mode of professional knowledge and establish a diversified evaluation index system including professional ability, ideological and political literacy, and moral practice^[14]. In addition to examining students' mastery of professional knowledge, such as accounting standards and financial analysis, ideological and political assessment dimensions, such as accounting professional ethics cognition, integrity awareness, and social responsibility practice, should also be added. Through tasks such as designing a "Financial Ethics Case Analysis Report," students' ability to transform ideological and political concepts into practical actions can be tested. At the same time, pay attention to students' team spirit in group cooperation and value judgment in financial decision-making to comprehensively measure their comprehensive qualities.

In terms of evaluation methods, adhere to the combination of process evaluation and final evaluation. Process evaluation runs through the whole teaching process, and records students' growth trajectories through their participation in classroom discussions, performance in case analysis, and value orientation in practical projects. With the help of the learning platform, track students' online learning of ideological and political resources and participation in topic discussions in real time, and provide timely feedback and adjust teaching strategies. Final evaluation is carried out through methods such as course papers and comprehensive case defense to conduct a summary evaluation of students' learning achievements at the end of the semester^[15].

5. Conclusion

Implementing curriculum ideological and political education in college accounting courses is an inevitable requirement for implementing the fundamental task of fostering virtue through education and cultivating high-quality accounting talents. Although certain achievements have been made at present, there are still problems such as insufficient teacher capabilities, rigid content integration, single teaching methods, and an imperfect evaluation system. Through paths such as strengthening the construction of the teaching staff, optimizing teaching content, innovating teaching methods, and perfecting the evaluation system, the organic integration of professional knowledge and ideological and political education can be achieved. In the future, it is expected to further deepen the teaching reform of curriculum ideological and political education in accounting courses, strengthen theoretical research and practical exploration, continuously improve the educational effectiveness, and provide excellent accounting talents with both ability and moral integrity for the accounting industry.

Disclosure statement

The author declares no conflict of interest.

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Exploration of Teaching Reform Strategies for the “Principles of Chemical Engineering” Course Based on the OBE Concept

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Abstract: Against the backdrop of “New Engineering,” how to strengthen students’ abilities in independent analysis, critical thinking, and innovative problem-solving while imparting traditional engineering knowledge has become a crucial issue for engineering universities in cultivating applied, interdisciplinary, and innovative chemical engineering talents. This paper expounds on the necessity of engineering education reform, outlines the importance of the “Principles of Chemical Engineering” course, and analyzes the problems existing in its teaching. Guided by the OBE (Outcome-Based Education) concept, the paper constructs the CDIO teaching model, focuses on three aspects, teaching content, teaching methods, and teaching evaluation, and explores teaching reform strategies for the “Principles of Chemical Engineering” course. It aims to provide a reference for optimizing the teaching model of chemical engineering-related courses.

Keywords: OBE concept; Principles of chemical engineering course; Teaching reform; Strategies

Online publication: October 21, 2025

1. Introduction

In February 2017, the Department of Higher Education of the Ministry of Education issued the “Notice on Carrying Out Research and Practice on ‘New Engineering’.” The notice points out that at the current stage, China needs to deepen the concept of engineering education to proactively respond to the new round of scientific and technological revolution and industrial transformation, serve the needs of national strategies and regional development, accelerate the development of “New Engineering,” explore and form a world-class engineering education system with Chinese characteristics, and promote China’s transformation from a large country in engineering education to a powerful one. OBE emphasizes designing teaching with final learning outcomes as the orientation, while CDIO focuses on the full-cycle practical training in engineering education. In the teaching of “Principles of Chemical Engineering”, the basis for the integration of OBE and CDIO lies in their joint commitment to improving students’ comprehensive literacy and professional capabilities in the field of chemical

engineering, to meet the demand of the chemical industry for innovative and practical talents. To implement the spirit of “transformation,” there is an urgent need to carry out teaching reform on the “Principles of Chemical Engineering” course. This reform should strengthen the connection between theoretical knowledge and practical application, and improve students’ ability to use theoretical knowledge to solve complex practical engineering problems. The ultimate goal is to achieve the cultivation of high-quality applied talents and better serve the rapid development of the regional economy under the new normal ^[1].

2. Problems in the teaching of the “Chemical Engineering Principles” course

At present, the “Chemical Engineering Principles” course in the chemical engineering discipline system still has many problems in cultivating talents for the “Emerging Engineering Education” initiative.

2.1. Disconnection between course theory and engineering practice

The theoretical knowledge of the course is delivered solely through teachers’ in-class lectures, resulting in a single teaching method and a lack of intuitive teaching tools. The practical segment mainly relies on chemical engineering principles and experiments, and there is a gap between the experimental operations that students participate in and actual engineering projects ^[2]. Teachers and schools fully rely on exam results to evaluate students’ engineering capabilities ^[3]. Since students’ understanding of engineering concepts comes entirely from teachers’ explanations in class, they have little exposure to real engineering practice in the course, leading to a lack of awareness of engineering concepts.

2.2. Teaching model neglects the cultivation of engineering competence

In terms of the course model, students’ learning process lacks interaction, and they have no concept of team collaboration. In the course evaluation system, only exam scores are considered, while the assessment of engineering competence is ignored, making the evaluation system overly simplistic. These problems in the educational process are far from meeting the training requirements for “Emerging Engineering Education” talents and urgently need to be studied and addressed ^[4]. Currently, engineering education focuses on the inculcation of knowledge points, lacking the cultivation of the ability to transform knowledge into practical application and the training of innovative capabilities. Therefore, against the backdrop of the new era, higher education institutions should reform the course teaching and evaluation system based on national policies and concepts, combined with modern information technology.

3. Teaching reform strategies for the “Principles of Chemical Engineering” course based on the OBE concept

3.1. Reconstructing the teaching content system in accordance with the OBE educational concept

In accordance with the OBE reverse design principle, the core knowledge that students need to master is identified. Teachers should start from the talent training program for chemistry majors, conduct research on and decompose the demands of job groups in the chemical engineering industry, and clarify the learning outcomes that students need to achieve based on the nature of the “Principles of Chemical Engineering” course ^[5].

Firstly, based on the corresponding relationship between job groups and students’ learning outcomes, the

course learning outcome objectives are defined: students should be able to proficiently master basic principles such as fluid flow, heat transfer, and mass transfer, and apply these principles to conduct calculations for chemical unit operations, equipment selection, and process flow design; they should also be able to analyze and solve common engineering problems in chemical production processes, and possess certain engineering practical capabilities and innovative thinking. Based on the course teaching content, teachers can refine the above-mentioned learning outcomes and formulate specific knowledge and skill objectives. For example, students should be able to accurately calculate parameters such as Reynolds number and heat transfer coefficient, and design the specifications and operating parameters of equipment like distillation columns and heat exchangers according to given conditions ^[6].

Secondly, teachers can reconstruct the teaching system of the “Principles of Chemical Engineering” course and develop modular teaching content based on the four stages of CDIO (Conceive, Design, Implement, Operate). In the Conceiving stage, real project cases from the chemical engineering industry are selected and transformed into project-based learning tasks, such as chemical product synthesis projects. These projects require students to learn and construct a knowledge framework, and put forward personal ideas from the perspectives of feasibility, technology, and solutions. In the Design stage, teachers organize project exploration activities, guiding students to combine the knowledge they have learned with project requirements to carry out process design and equipment selection exploration; through in-depth thinking and exploration, students can gain a deeper understanding of the application value of principles such as mass transfer and heat transfer ^[7]. In the Implementing stage, students use simulation experiments or hands-on experiments to verify the feasibility of the design scheme, and with the help of result feedback from virtual simulation software, they promptly identify and solve problems, optimize the operation process, and exercise their ability to solve practical problems. In the Operating stage, students are required to maintain and improve the project, reflect the complete project implementation process in project reports and technical documents, which helps cultivate their engineering management and teamwork abilities and further enables them to master the entire process of chemical production.

3.2. Optimizing course teaching methods driven by the CDIO model

Under the guidance of OBE (outcome-based education), teachers can apply the CDIO engineering education model and combine it with traditional teaching methods.

Firstly, innovatively apply the project-driven teaching method. Teachers can design a series of “Principles of Chemical Engineering” projects, and the implementation of this method runs through three links: pre-class, in-class, and post-class ^[8]. Before class, teachers prepare materials while students search for relevant information, and they work together to determine the project theme; during class, teachers explain the content of project tasks, adopt a group cooperation approach to organize students in in-class exploration activities, arrange groups to take turns presenting their ideas, and provide comments on each group’s performance; after class, teachers conduct Q&A sessions to address unresolved issues from the class, help students adjust and improve the project content, and appropriately extend and expand knowledge related to the project. For example, with “designing a shell-and-tube heat exchanger” as the project theme, student teams need to complete the entire process from project conception (determining design tasks, equipment types, etc.), design (detailed design calculation methods, heat transfer rate equations, heat balance calculations, etc.), implementation (building an experimental model or completing virtual simulation operations) to operation (monitoring operation effects and conducting optimization adjustments).

Secondly, the case teaching method is applied innovatively: teachers should integrate the course content with

chemical production cases, such as the crude oil distillation process in large-scale petrochemical enterprises and the drug synthesis and purification process in pharmaceutical enterprises, and design a series of case exploration topics^[9]. In teaching, first, in accordance with the OBE concept, put forward learning outcome-related questions about the cases, such as “analyze the energy-saving measures in the heat transfer link of this process and propose improvement plans based on the knowledge of chemical engineering principles”. Then, use the CDIO model to guide students in analyzing the cases, covering the process from conceiving the process principles, designing improvement plans, implementing plan simulation or experimental verification to operating the implementation and evaluation of the plans^[10]. Through case teaching, students can gain a deep understanding of the application of chemical engineering principles in actual production, while developing their ability to analyze and solve problems, enabling them to gradually achieve the expected learning outcomes.

3.3. Focus on students’ learning outcomes and reconstruct the teaching evaluation system

The OBE (Outcome-Based Education) concept emphasizes student-centeredness. Teachers should focus on evaluating students’ performance throughout the learning process and establish a diversified evaluation system^[11]. To objectively record and assess students’ process-based learning performance, teachers should design self-evaluation and peer-evaluation sessions. They may also invite professionals from enterprises or other teachers to evaluate students in aspects such as their understanding of theoretical knowledge, calculation proficiency, experimental operation skills, and teamwork performance, so as to conduct a comprehensive assessment of students’ learning abilities and learning outcomes^[12]. During the implementation of the project, students can independently comment on their personal gains, team contributions, and existing shortcomings. Meanwhile, group members can provide feedback on each other’s knowledge application, communication skills, and work performance. All this data is uniformly submitted to teachers for review. Guided by the OBE outcome-oriented principle, teachers should refine the evaluation criteria and establish an evaluation index system covering three dimensions: knowledge, ability, and literacy. This system aims to assess students’ mastery of the theoretical knowledge of Chemical Engineering Principles, their innovative ability, communication skills, and teamwork ability demonstrated in the process of discussing project solutions, as well as their awareness of concepts such as green environmental protection, engineering safety, and scientific rigor reflected in their literacy performance. By building a comprehensive evaluation index, an “evaluation-feedback-incentive” mechanism is formed to encourage students to continuously strive for better learning outcomes^[13].

4. Achievements of project implementation

4.1. Enhanced the integration of theory and practice

Traditional Chemical Engineering Principles classes are usually limited to in-class lectures, where students are mostly engaged in absorbing theoretical knowledge and lack opportunities to connect knowledge with engineering practice^[14]. After reconstructing the teaching model under the OBE concept, real projects are organically integrated into the curriculum design and practice. This enables students to understand and apply curriculum knowledge through project analysis and practice, strengthens the connection between theoretical learning and experimental design, and helps students gain an in-depth understanding of abstract knowledge in practice. Thus, it makes up for the deficiency in integrating theory and practice in traditional classrooms.

4.2. Significantly improved students' learning initiative

In traditional teaching, students are in a passive learning position and show low enthusiasm for participating in in-class exploration. By establishing and implementing the OBE-CDIO teaching model, the central role of students in project-based learning and case analysis is highlighted, allowing them to truly experience the entire practical process of a project and stimulating their interest in learning. Additionally, with the integration of a diversified evaluation system, students' learning processes and outcomes can be recorded, which reflects their learning performance and achievement levels in project participation. This further inspires students' enthusiasm for innovative thinking and problem-solving, and enhances their initiative to participate in classroom activities.

4.3. Fully aligning teaching content with industry needs

The content of traditional Chemical Engineering Principles courses often lags behind the development of the chemical industry^[15]. By implementing teaching reforms guided by the Outcome-Based Education (OBE) concept, we can base our efforts on the latest needs of the chemical industry, select cases of new processes and technologies from the industry, and transform them into curriculum teaching projects. This allows students to access industry-related content corresponding to the course theories, helping them understand industry needs and fostering engineering and technical talents who can adapt to the development requirements of the industry.

5. Conclusion

To sum up, centering on the OBE educational concept, adopting a reverse design approach, determining course teaching objectives based on industry needs, and designing students' learning outcome objectives to promote the teaching reform of the Chemical Engineering Principles course are conducive to advancing the update and development of the course teaching system and enhancing the comprehensiveness and practicality of teaching activities. Therefore, teachers should adhere to the outcome-based education concept, continuously pay attention to and understand the needs of the chemical industry, decompose the teaching objectives of the Chemical Engineering Principles course in a targeted manner, and design learning outcome objectives essential for students' future employment and development. In the implementation process, by integrating the CDIO (Conceive, Design, Implement, Operate) engineering education model and following the framework of conception, design, implementation, and operation, a curriculum system that integrates core knowledge modules with chemical engineering stages should be established. This system should balance students' knowledge acquisition and practical ability cultivation, enabling them to learn knowledge purposefully and solve problems in the process of analyzing and addressing project cases, thereby improving the overall teaching effectiveness of the course.

Funding

Teaching Reform and Exploration of the "Principles of Chemical Engineering" Course Based on the OBE-CDIO Teaching Model (Project No.: TDGJYB2518)

Disclosure statement

The author declares no conflict of interest.

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A Study of High School English Reading Teaching with Visual Thinking Incorporated into the 5E Teaching Model

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Abstract: Reading questions account for a large portion of the scores in China's college entrance English examination, therefore teachers and researchers have been studying how to teach high school English reading more effectively. In recent years, the 5E teaching model has been highly praised by teachers, which, as a constructivist's learning framework, provides students with a complete learning path from engagement to evaluation. However, English reading requires students to have reading comprehension skills. And visual thinking, as a powerful cognitive tool, can assist students in organizing and comprehending information in graphical and problematic ways. The article aims to investigate how to combine the two well in order to apply them to high school English reading teaching. It is found that the integration of visualization tools into the 5E teaching model can not only help students improve their reading comprehension, but also improve teachers' teaching efficiency.

Keywords: Visual thinking; 5E teaching model; High school english reading

Online publication: October 21, 2025

1. Introduction

“The English Curriculum Standard for General High Schools” (2017 Edition Revised in 2020) ^[1] emphasizes that English teaching in high schools should focus on students' core literacy, which includes the development of students' thinking quality. English reading, as an important part of language learning, has always been concerned by educators and researchers. However, traditional reading teaching is only one-sidedly explaining grammar and translating texts, neglecting the development of students' thinking quality; it is only teacher-centered which ignores students' needs. The 5E teaching model, however, is student-centered and helps to improve students' thinking quality by guiding them from inquiry to problem solving through five stages: engagement, exploration, explanation, elaboration and evaluation.

Currently, the 5E teaching model has been widely researched and applied in the field of science, but relatively little research has been done in language teaching, especially in high school English reading teaching.

Although some scholars have begun to try to apply the 5E teaching model to the English classroom, no systematic conclusions have been drawn as to how it should be operated. However, the 5E teaching mode can improve and enrich all the links before reading, during reading, and after reading, so that the teaching effect can be greatly improved. Moreover, English reading requires students to have the ability of discourse comprehension and discourse thinking. How to improve these two abilities in the English reading classroom, and how to stimulate students' motivation and interest in reading, is particularly important.

Based on the above research status, this paper proposes to adopt the method of integrating visual thinking into the 5E teaching mode to teach high school English reading. Visual thinking is a kind of thinking aid, and students applying it to English reading can help them sort out and process information so as to better understand and memorize the content in reading materials. By combining visualization strategies with the 5E teaching model, it is hoped that a new approach to teaching reading can be provided for teachers.

2. Related concepts

2.1. Visual thinking

“Visual thinking” is a concept introduced by Harvard scholars Shari and Palmer in their strategy research in the 1960s, who defined visual thinking as “Record the thinking, questioning, reasoning, or reflection process of individuals or groups in any observable form”, and its core idea is: make thinking visible ^[2].

Foreign scholars have invented a lot of visual thinking tools; the most representative in teaching is the mind map. Mind mapping was invented by Tony Buzan, a British psychologist in the 1960s. He believes that mind mapping is to express human divergent thinking, so mind mapping is also a natural function of human thinking ^[3]. Common mind mapping tools include XMind, Zhixi, FreeMind, MindNode and so on.

In addition to mind maps, there are many forms of visual thinking, such as the concept map proposed by psychologist Novak. A concept map is a tool used to organize and represent knowledge, which uses nodes to represent concepts themselves, lines to show relationships between concepts, and emphasizes the hierarchy and interdependence between concepts ^[4]. Ralph Lengler and Martin J. Eppler, two scholars, also constructed a “visualization method periodic table”. They combined many visual aids to create an organized chart similar to the periodic table of chemical elements. This table aims to help understand and distinguish different visualization techniques, to more effectively express and communicate information through graphics ^[5]. There is also the “Six Thinking Hats” developed by Dr. Edward de Bono of the University of Cambridge in the UK, which divides the thinking process into six different “hats”, each representing a specific way of thinking, encouraging people to examine problems from different perspectives (such as facts, intuition, risks, etc.) ^[3]. In addition, Liu ^[6] proposed a five-level thinking visualization teaching system, including the concept transformation layer, method and technology layer, curriculum design layer, classroom environment layer, and effectiveness evaluation layer. This system aims to integrate visual thinking into various levels of teaching to promote the development of students' thinking abilities. In foreign countries, visual thinking has been widely applied. Harvard University and Cambridge University have also incorporated visualization of thinking into their courses. For example, Shatri et al. ^[7] believe that using visual thinking in teaching is beneficial for students' critical thinking growth. Since the 21st century, visual thinking has been increasingly applied in Chinese classrooms. For example, Jin et al. ^[8] use visual thinking tools to encourage students to read based on language input, which can develop their reading skills, and improve their ability to integrate reading knowledge.

2.2. 5E teaching model

The 5E teaching model was proposed by The Biological Sciences Curriculum Study (BSCS) in the United States. At first, in their research on improving the science curriculum in the United States, Bybee et al. ^[9] proposed the “learning cycle model,” which was the prototype of the 5E teaching model and included “preliminary” “exploration,” “invention,” and “discovery.” However, based on teaching experiments and implementation, they believed that emphasizing students’ independent exploration and creativity in the early stages of learning posed certain challenges. Therefore, Bybee et al. ^[9] extended the learning cycle process to five stages: engagement, exploration, explanation, elaboration, and evaluation. This is the 5E teaching model, named after the English word “E” in all five steps. Wang et al. ^[10] believe that in the 5E teaching model, students are the main body and teachers only play a leading role. The 5E teaching model triggers students’ cognitive conflicts by setting problem scenarios and includes a series of teaching activities focused on constructing new knowledge, such as explanation, extension, and application. These activities embody a student-centered approach and allow students to explore independently, with teachers only providing guidance and assistance on the side.

The 5E teaching model has been widely applied in scientific classrooms abroad. In terms of effectiveness, Bybee et al. ^[9] demonstrated through teaching experiments that the 5E teaching model is more effective in improving students’ academic performance and learning interest compared to traditional models. Mcwright ^[11] simultaneously chose two modes for comparative teaching: one is the traditional method, and the other is the 5E method. The research results indicate that classes using the 5E teaching model have more innovative personal ideas in science reading and writing, and are more interested in chemistry classes and chemistry-related extracurricular activities. In terms of the English subject, Li ^[12] conducted experiments using the 5E teaching model in her graduate English reading class. The teaching effect shows that the 5E teaching model can improve and strengthen students’ logical thinking ability in the educational process, while stimulating their research interest.

Overall, the 5E teaching model enables students to independently understand knowledge and construct knowledge frameworks through active student participation and effective teacher guidance. It is a successful classroom teaching strategy that emphasizes both the role of teachers and students.

3. The feasibility of visual thinking in various aspects of 5E reading teaching

3.1. Engagement

In the participation stage, teachers set up scenarios to stimulate students’ interest, attract their attention, and improve their learning motivation. In this process, teachers can use a series of visual thinking forms to help students activate old knowledge and inspire new knowledge. Firstly, teachers can use multimedia tools such as images and videos to present content related to text, enabling students to have a more intuitive understanding of the knowledge they are learning and enhancing their interest in learning. Secondly, teachers can also use the KWL (Know, Want to Know, Learned) form to ask students to list the information they already know, the questions they want to know, and the new knowledge they have learned after reading. In this way, students can enter reading with questions and use known information to facilitate understanding. Secondly, students can also engage in brainstorming by writing down their thoughts, and then create a text cloud map based on the keywords they have written down, allowing them to guess the content of the discourse based on the cloud map. Students can also create mind maps based on the content of brainstorming sessions to organize their own ideas.

Through these forms of visual thinking, students can actively participate in English reading classes,

improving their reading comprehension abilities and learning interests. At the same time, these methods also help teachers to design and implement teaching more effectively, thus improving teaching effectiveness.

3.2. Exploration

In the exploration stage, students collaborate independently to explore, and teachers provide scaffolding to encourage students to actively learn and think. In this process, teachers can use visual thinking tools to help students actively think and explore new knowledge. Firstly, teachers can use fishbone diagrams to help students analyze the reasons and results of the text, which helps students understand causal relationships. Secondly, students can also construct a mind map to better clarify their ideas, grasp the structure and key points of the article, and thus have a deeper understanding and digestion of the knowledge they have learned. Tools such as reading logs can also be used to allow students to read with questions, search for answers, and summarize the knowledge they have learned in reading comprehension, thereby promoting the process of students from not knowing to knowing, and then from knowing less to knowing more. In addition, teachers can also have students create storyboards to present the main events and plot of the text in the form of comic strips, helping students grasp the story flow and main characters.

In addition to these, there are many forms in which teachers can design activities that are close to students' actual situations based on their own abilities and student situations, making teaching more vivid and effective. These visual thinking forms can not only help students better understand and memorize reading materials, but also stimulate their interest and autonomy, thereby improving their English reading proficiency.

3.3. Explanation

In the explanation stage, students collaborate to exchange and discuss the results, and teachers help students verify the conclusions of the exploration process, connecting new knowledge with existing knowledge. In this process, for texts involving historical events or developmental processes, teachers can create timelines to help students understand the sequence and temporal relationships of events. For texts involving related relationships, teachers can use Venn diagrams to compare and contrast characters, events, or concepts in the text, so that students can clearly see the similarities and differences between them. Teachers can also set up a problem chain that progresses layer by layer, allowing students to understand the text and explore its deeper meaning. By applying visual thinking in the explanation process, students can further understand the text, explore its details, and elevate their emotions.

3.4. Elaboration

In the elaboration process, students apply newly learned knowledge to solve problems or conduct deeper exploration, to deepen their understanding and memory of knowledge and cultivate problem-solving abilities. Teachers can create a new context similar to the text, allowing students to interpret or solve the situation through role-playing or debate. This interactive activity helps students deepen their understanding of the text content. Students can also engage in writing, combining reading and writing, to improve their writing skills and critical thinking when solving new situational problems. Before writing, students can create a brainstorming mind map to help them clarify their writing ideas. By integrating mind maps into transfer activities, the role of visual thinking in the 5E teaching mode will be fully realized. Secondly, teachers can provide students with a real-life case related to the text for research and discussion. Students can combine theoretical knowledge with practical situations to improve their problem-solving abilities.

3.5. Evaluation

Finally, in the evaluation stage, teachers conduct a comprehensive evaluation of students, using various methods such as process evaluation and summative evaluation, teacher evaluation, student self-evaluation, and student peer evaluation, to promote students' learning from each other's strengths and weaknesses, and to identify and fill in gaps. Teachers can design an evaluation form, which is a visual way of thinking that allows students to clearly see their shortcomings and make timely corrections and improvements. In addition, teachers can also incorporate process evaluations into reading instruction, such as using graphical progress bars to display students' progress in completing reading tasks, giving them a clear understanding of their learning. In addition, students can set reading goals together and use charts to track and evaluate the achievement of these goals, which helps students clarify their learning objectives and strive to achieve them.

4. Case study of integrating visual thinking into the 5E teaching model in high school English reading teaching

The study will briefly analyze and demonstrate the specific application of visual thinking integrated into the 5E teaching model in high school English reading teaching, using the reading section "From Problems to Solutions" from the People's Education Press (2019) Book 2 Unit 1 in this chapter.

4.1. Analysis of teaching materials

- (1) What: The textbook is sourced from the Reading and Thinking section of Unit 1 in Volume 2 of the People's Education Press, with the theme of cultural heritage. The theme of the reading passage is people and society: it tells the story of history, society and culture, as well as the protection of cultural heritage. This article discusses the problems and solutions faced in the construction of the Aswan Dam.
- (2) Why: This text enables students to understand the complexity and difficulty of issues in the process of cultural heritage protection, the possibility of balancing economic development and historical cultural heritage protection, and the importance of global cooperation in cultural heritage protection, thereby further reflecting on how they can effectively participate in cultural heritage protection activities in their daily lives. This chapter aims to raise students' awareness of protecting cultural heritage and establish the concept of a community with a shared future for mankind.
- (3) How: This article belongs to the category of narrative explanatory text, with clear structure, accurate wording, and the use of many numbers to make the content precise. The language is simple, easy to understand, and full of authenticity.

4.2. Analysis of students

The student comes from the first year of high school. After three years of English learning in junior high school, they have mastered the basic abilities of obtaining information, processing information, analyzing problems, and common reading skills. Before teaching, students have already previewed new vocabulary and cleared obstacles to reading the text. However, students' logical and critical thinking abilities still need to be strengthened. They may want to learn more about the Aswan Dam project and how to protect cultural heritage.

4.3. Teaching objectives

At the end of this course, students will be able to: obtain basic information and text structure of the Aswan

Dam project; understand the importance of cultural heritage protection and cooperation among major countries; summarize by using reading skills to acquire, organize, forming one's own insights and cultivating abstract thinking abilities; apply the problem-solving steps learned to analyze cultural relic protection cases, and solve practical problems in daily life through group debates.

4.4. Teaching key and difficult points

The teaching key point is that students can obtain basic information and text structure of the Aswan Dam project. The teaching difficult point is that students can express their views on cultural heritage protection and apply the knowledge they have learned to solve practical problems.

4.5. Teaching procedure

(1) Warm-up (Participation Stage)

The teacher shows a photo of the Abu Simbel Temple and asks the students to guess which country the photo is about and whether they know the name of the attraction.

Justification: To lead students into the theme of this lesson and attract their interest through visual aids such as images.

(2) Lead in (Participation Stage)

The teacher will first present two questions: 1. What happened to the statues? 2. Please use some adjectives to describe your feelings. Then play a video about the Abu Simbel Temple and ask the students to answer the above two questions. Then ask the students what more information they would like to know about the Abu Simbel Temple?

Justification: To further educate students about the history of the Abu Simbel Temple through visual means such as videos, and to stimulate their desire to explore.

(3) Pre-reading (exploration stage)

Activity 1: Prediction

Next, the teacher says to the students: Now let's enter today's learning and see if we can learn what you want to know. Then the teacher asks the students: What question do you think of when you read the title? (Based on keywords: problems and solutions)

Justification: Encourage students to ask questions themselves and become active explorers of knowledge.

(4) While-reading (exploration and explanation stage)

Activity 2: Read for structure

Scenario one: We are now going on a trip to the Abu Simbel Temple. You and your desk mate will play the role of tourists, while the other will serve as a tour guide. Tourists can ask the tour guide questions that come to mind during the prediction process, and the tour guide will answer them based on the text. During this process, tourists need to design a fish-bone diagram based on the tour guide's answers (you can connect them together using when, what, where, who, how, why, etc., and then write the theme idea on the fish-bone spine).

Activity 3: Read for details

Scenario 2: Your friend Xiao Ming also wants to learn about the history of the Abu Simbel Temple. Please introduce to him what happened during each time period. Students complete the timeline under the guidance of the teacher

(5) Post-reading (elaboration stage)

Activity 4: Think and debate

Scenario 3: Xiaoming is also from Guangdong. There is an ancient architectural complex in his hometown, but it is currently facing demolition due to Guangdong's "Three Olds Renovation" (old factories, old villages, and old urban areas). What is your opinion on this? Do you think it should be demolished or preserved? How to strike a balance between economic development and the protection of the surrounding cultural heritage?

The teacher shows the students the mind map, and then the students are grouped according to the prompts on the mind map for a debate competition. The teacher then completes the mind map on the blackboard based on the students' expressions.

(6) Summary (Evaluation Stage)

The teacher guides the students to summarize what they have learned in class and asks them to complete an evaluation form.

(7) Homework

Students write a letter of about 100 words to the government based on the mind map on the blackboard, stating their views and suggestions on the "Three Olds Renovation". Through homework, students can further consolidate, transfer, and apply the knowledge they have learned. Using mind maps to complete writing helps students organize their article structure and improve their communication skills.

5. Conclusion

Integrating visual thinking into the 5E teaching model provides a new perspective and method for high school English reading teaching, making students' learning process more vivid, interesting, and effective, as well as giving teachers more direction and improving their teaching efficiency. However, the 5E teaching model is not yet widely adopted in English classrooms in China, which requires teachers to have strong teaching abilities and the ability to control the classroom. Otherwise, giving students too much autonomy may not be conducive to their success in exam-oriented education, especially for students with lower levels and poor self-control. Therefore, more exploration and practice are needed to prove its effectiveness in this study.

In future English reading teaching, it is hoped that scholars can continue to explore and practice more visual thinking forms to continuously improve teaching quality and students' learning experience. The study believes this teaching method will open a door to a wider world for students, help them better understand and master English reading skills, and lay a solid foundation for future learning and life.

Disclosure statement

The author declares no conflict of interest.

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Study on the Paths and Strategies of Integrating Ideological and Political Education into Student Management

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Abstract: Against the backdrop of the ever-changing social environment today, integrating ideological and political education into student management has become a crucial foundation for colleges and universities to improve the quality of talent cultivation and foster the all-around development of students. Based on this, this paper conducts an in-depth exploration of the relationship between ideological and political education and student management, the logic of integrating ideological and political education into student management, and the establishment of a collaborative working mechanism between ideological and political education and student management. The purpose is to better contribute to social development and promote the all-round development of students.

Keywords: Ideological and political education; Student management; Paths and strategies

Online publication: October 17, 2025

1. Introduction

The “Implementation Plan for the Reform and Innovation of Ideological and Political Theory Courses in Schools in the New Era” clearly states two key points: first, grasping the new era. The Thought on Socialism with Chinese Characteristics for a New Era should be reflected in the curriculum objectives, curriculum settings, and curriculum teaching material contents of all stages from primary schools to universities, achieving full coverage and penetration throughout the entire process. Second, advancing integration. A curriculum and teaching material system should be established, featuring progressive development across all vertical school stages, close coordination among all horizontal courses, and mutual alignment between compulsory courses and elective courses, so as to realize the effective connection of curriculum objectives, curriculum settings, and curriculum teaching material contents. Colleges and universities should follow the path in line with national development in accordance with national policy documents, which is essential for better talent cultivation^[1]. From the social perspective, in the current era of information explosion and cultural diversity, various ideological trends collide with each other. Students’ ideological concepts and value orientations are highly susceptible

to external influences, leading to fluctuations. Therefore, integrating ideological and political education into student management can help students build a solid ideological defense line, enabling them to resist the erosion of negative ideologies, establish a correct worldview, outlook on life, and values, and maintain a clear mind and firm stance in the complex and ever-changing social environment.

2. The relationship between ideological and political education and student management

2.1. Guiding the formation of students' correct values through ideological and political education

Colleges and universities promote students' all-round development by using ideological and political education to correct students' thinking and student management to achieve teaching goals. There is a certain mutual influence between student management and ideological and political education: ideological and political education helps students establish correct values, and these values, in turn, promote the effectiveness of student management. Ideological and political education enables students to form a correct worldview, outlook on life, and values, thereby helping them accurately judge the direction of their career development and life goals ^[2]. Among them, student management takes students' development needs as its orientation and the promotion of students' all-round development as its goal, thus better integrating ideological and political education into its work. Guided by ideological and political education, students can better abide by socialist values and move in the correct development direction, which in turn promotes the all-round improvement of their comprehensive quality. In specific practice, student management can provide a practical platform for ideological and political education, enabling its concepts to be implemented in real scenarios ^[3].

2.2. The guiding role of ideological and political education in regulating students' behaviors

By guiding students' thinking and ideology, ideological and political education can standardize students' behaviors more effectively, that is, help students establish correct concepts of behavior ^[4]. Through diversified educational forms, ideological and political education enables students to gain a deeper understanding of social reality issues, the context of historical development, and the essence of life. This helps students build a correct value judgment system and behavioral guiding principles, ensuring that they can adhere to their original aspirations and make correct choices even when facing decisions in the future. In the student management system of colleges and universities, the innovative concepts of ideological and political education can be transformed into specific codes of conduct. This allows students to internalize the core socialist values into their hearts and externalize them into their actions within the framework of customized rules and regulations ^[5]. Specifically, ideological and political education shapes students' moral character by strengthening their moral cognition, sense of responsibility, and cultivation of behavioral habits, helping them establish a positive outlook on life and morality, and form a healthy and upward development direction. Student management can enhance students' comprehensive quality, stimulate their sense of social responsibility, and promote the dual development of their values and morality through various events and activities. In addition, ideological and political education also cultivates students' ability to distinguish right from wrong and their autonomy, enabling them to better adapt to social rules and live a more fulfilling life. Student management, on the other hand, helps students develop self-discipline, reminding them not to lose sight of their own development goals. This forms a positive cycle,

facilitating the realization of students' all-round development.

2.3. The interactive relationship between ideological and political education and the development of students' comprehensive quality

Value education and ideological guidance can comprehensively improve students' comprehensive quality. Student management should formulate management rules and strategies based on respecting students' diverse needs, to better promote students' all-around development. Ideological and political education, through a variety of activity contents and classroom teaching materials, helps students establish correct values, thereby making them understand the importance of developing their overall abilities for their career development^[6]. Based on this, student management should take ideological and political education as its foundation. Only in this way can it better provide students with a platform for all-round development and promote their comprehensive growth. Besides, colleges and universities can also establish an evaluation system to gain a comprehensive understanding of students' development status, to improve the quality of student management. Among other things, teachers engaged in student management work need to provide targeted guidance to students according to their interests and characteristics. Ideological and political education should provide appropriate guidance to students in all aspects of teachers' student management work, so as to better promote students' growth and development^[7]. In return, student management can offer guidance and suggestions for ideological and political education activities based on students' actual development, helping to form a state where "each is integrated into the other". This enables students to better absorb knowledge. Carrying out ideological and political education activities not only allows student management work to accumulate valuable experience, but also provides better support for the formulation of teaching strategies and methods^[8].

3. The logic of integrating ideological and political education into student management

3.1. Consistency in concepts and goals

For the better development of student management and ideological and political education, their concepts and goals must be aligned. Only in this way can both parties continue to move forward toward the set goals after defining them. The development concept of student management is to provide students with support in various aspects based on their individual development status, thereby better promoting students' growth. In contrast, the development concept of ideological and political education focuses on cultivating students into well-rounded talents needed by society, helping them better determine their career directions^[9]. It is evident that both take students as the foundation for cultivation. Therefore, the consistency in concepts and goals between student management and ideological and political education can provide a solid foundation for the development of both. The goal of ideological and political education is to help students establish a correct outlook on development and make steady progress in accordance with this outlook. The goal of student management is to enable students to develop a certain sense of innovation and social responsibility while pursuing standardized development. Importantly, both goals are oriented toward guiding students to align their life and study with the development requirements of socialist core values^[10].

3.2. Collaborative application of integrative teaching methods and management strategies

At the institutional level, schools can formulate a series of rules and regulations, integrating the requirements and

goals of ideological and political education into various provisions for student management. By standardizing students' behaviors, schools can guide them to establish correct values. For instance, a sound reward and punishment mechanism can be established: students who perform excellently in ideological and political education are recognized and rewarded, while appropriate penalties are imposed on behaviors that violate the requirements of ideological and political education. This approach helps strengthen students' awareness of rules and moral concepts^[11]. At the environmental level, it is crucial to create a positive campus environment rich in the atmosphere of ideological and political education. Through campus culture construction, such as organizing themed activities, building cultural corridors, and holding lectures, universities allow students to be influenced and inspired in an environment filled with positive energy. The cultural level emphasizes the construction of campus culture with the characteristics of ideological and political education, integrating ideological and political concepts into the school's spiritual culture, institutional culture, and behavioral culture, so that students can internally identify with and practice the values of ideological and political education. The coordinated application of immersive teaching methods and management strategies is a complementary and mutually reinforcing relationship. Teaching methods provide specific approaches and means for the implementation of management strategies, enabling ideological and political education to be truly implemented; meanwhile, management strategies offer institutional guarantees and environmental support for the effective development of teaching methods, ensuring that ideological and political education can be promoted continuously and stably in student management. Only by organically combining the two can a strong educational synergy be formed, realizing the in-depth integration of ideological and political education and student management^[12]. Additionally, teachers should focus on individualized education, which means flexibly applying teaching methods and management strategies according to the different characteristics and needs of students to enhance the pertinence and effectiveness of ideological and political education. Only in this way can the goal of integrating ideological and political education into student management be truly achieved, and cultivate new-era youth with noble virtues, a strong sense of social responsibility, and good comprehensive qualities.

4. Paths and strategies for integrating ideological and political education into student management

4.1. Establish a collaborative working mechanism between ideological and political education and student management

To better integrate ideological and political education into student management, colleges and universities can achieve deeper integration of the two by building a collaborative working mechanism^[13]. Firstly, colleges and universities may form a professional teacher team consisting of ideological and political education teachers and student management leaders to take charge of students' ideological and political education and student management work. Clear responsibilities should be assigned to each teacher in the team, ensuring that ideological and political education teachers and student management leaders can communicate and interact more carefully and thoroughly when formulating plans and making decisions, thereby optimizing work arrangements. Secondly, colleges and universities can establish a platform system for the teaching team, enabling student management staff to gain a more in-depth understanding of ideological and political education, while also allowing ideological and political educators to fully grasp the status of student management. This mutual understanding facilitates the promotion of in-depth integration between the two fields^[14]. Finally, colleges and universities can regularly organize meetings involving both student management and ideological and political education personnel. During

these meetings, team leaders from both sides can deliver speeches to jointly discuss the future development direction. The specific content of the plans can then be revised based on the opinions and suggestions of other team members and teachers, ensuring the effective implementation of the plans.

4.2. Innovate the forms of ideological and political education to stimulate students' learning interest

To better integrate student management with ideological and political education, colleges and universities can innovate the forms of ideological and political education to stimulate students' interest in learning and enhance the pertinence and developmental nature of such education. First, colleges and universities can enrich the forms of ideological and political education through artificial intelligence technology. They can leverage AI platforms, networks, and devices to carry out ideological and political education activities, which helps attract more students to participate. For example, teachers can use teaching platforms to enable students to learn ideological and political courses online; they can also utilize VR and AR technologies to provide participants with an immersive experience. Second, colleges and universities can enhance the pertinence of ideological and political education through practical activities. By organizing students to participate in social practice activities such as the "Three Goes to the Countryside" program and "volunteer services," they allow students to better experience the connotation of ideological and political education in practice, thereby exerting a subtle influence on their own behaviors. At the same time, colleges and universities can also organize ideological and political education activities related to management, such as mental health education and code of conduct education, so that ideological and political education can be carried out in a targeted manner according to the different needs of students. Third, ideological and political education should be integrated into every link of student management. In the code of conduct, rules and regulations, and reward and punishment systems for student management, colleges and universities can incorporate ideological and political education into every detail, enabling students to subtly practice the content of ideological and political education ^[15].

4.3. Strengthen ideological communication and interaction between teachers and students

In the process of integrating student management with ideological and political education, teachers need to pay attention to the difficulties and challenges students face in their growth and interactions. Based on the individual circumstances of each student, teachers should provide guidance to help them establish correct outlooks on the world, life, and values. Teachers can adopt diverse teaching methods and strategies to attract students to participate in ideological and political practice activities, effectively stimulating their learning interest and encouraging them to engage more actively in learning. During the integration of ideological and political education with student management, teachers should maintain frequent communication and interaction with students to gain a better understanding of their thoughts and provide targeted guidance. When students participate in class discussions and group cooperation, teachers should guide them to conduct independent thinking indirectly. This helps cultivate students' awareness of innovative development and critical thinking ability, thereby enhancing their core literacy. At the same time, in the process of student management and ideological and political education, teachers should formulate working methods based on students' suggestions and opinions, creating an unrestrained development space for students.

4.4. Build a diversified and open platform for ideological and political education

To better integrate student management with ideological and political education, colleges and universities

can establish ideological and political education platforms for students, enabling them to learn anytime and anywhere, and facilitating in-depth integration and development of ideological and political education and student management. In the learning module of the ideological and political education platform, students can independently study ideological and political theories and knowledge related to social sciences. The system will also dynamically push relevant content to students based on their browsing history. In the communication module of the platform, students can discuss and exchange ideas with peers from other majors regarding issues they do not understand, allowing them to not only think from one perspective but also develop more open-minded thinking through interactions with other students. In the in-depth communication module of the ideological and political education platform, experts and scholars will explain certain issues, and students can interact with them by leaving messages. In the practice module, after students finish learning theoretical knowledge, the platform will automatically form study groups and let them select a project for practical implementation. This not only expands students' social circles but also cultivates their sense of teamwork. In the management module of the ideological and political education platform, students can view the school's management systems and the student union's management systems, and put forward opinions and suggestions to ensure the smooth implementation of management work.

5. Conclusion

The integration of ideological and political education into student management is a long-term, arduous, and systematic project. It not only requires educators to continuously explore and practice but also demands close attention to students' development. Although this study puts forward some insights regarding paths and strategies, many difficulties are still encountered in the actual implementation process. With the development of the times and social progress, students' ideological concepts and behavioral patterns are constantly changing, which places higher requirements on the integration of ideological and political education into student management. Beyond this, this study can also provide certain reference significance for relevant researchers, thereby promoting the in-depth integration and development of the two (ideological and political education and student management).

Disclosure statement

The author declares no conflict of interest.

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Research on Teaching Methods and Talent Cultivation of Digital Media in Higher Vocational Colleges Empowered by AI

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Abstract: Against the backdrop of AIGC driving the transformation of the digital media industry and a 300% surge in job demands, higher vocational education is presented with an opportunity to narrow the gap with undergraduate institutions. Anhui Communications Vocational and Technical College took the lead in exploring the empowerment of teaching by AIGC. By setting up a generative artificial intelligence micro-major and reconstructing the curriculum system, it integrated the latest AIGC large models and application tools into teaching, and enhanced classroom vitality through the “case demonstration + interactive discussion” mode. We have established AIGC training rooms, deepened school-enterprise cooperation, and, on average, over 100 students participate in practical enterprise projects each year^[1]. Practice has proved that students’ creative efficiency has significantly improved, with the winning rate in provincial competitions increasing by 40% and the employment rate in the metaverse field growing by 35%. The training model of “basic courses + tool training + industrial projects” constructed by the college provides a replicable model for the teaching reform of the digital media major in higher vocational colleges in the AIGC era^[2].

Keywords: AIGC; Higher vocational education; Digital media teaching; Talent cultivation mode

Online publication: October 17, 2025

1. Research background

In the wave of rapid iteration of artificial intelligence technology, AIGC (Artificial Intelligence Generated Content) has become the core force driving the transformation of the digital media industry. From intelligent image generation to interactive video creation, AIGC has not only reshaped the content production process but also given rise to new professional forms such as virtual anchors and AI art design. According to industry reports, it is expected that by 2025, the demand for AIGC-related positions will increase by more than 300%, which poses an urgent transformation requirement for the talent cultivation of the Digital Media and Design major in higher vocational colleges.

In the current era, when the AIGC wave is sweeping through the digital media industry, vocational college

students are presented with unprecedented development opportunities. This technological innovation has significantly narrowed the gap between them and students from undergraduate institutions. First of all, the characteristic of higher vocational education that emphasizes practical teaching is highly consistent with the practical application requirements of AIGC. Compared with the training mode of undergraduate colleges that mainly focus on theoretical research, higher vocational colleges can quickly integrate AIGC tools into practical training courses. Through school-enterprise cooperation projects, students can operate AIGC tools in real scenarios and accumulate practical experience^[3]. For instance, in the short video production course, vocational college students can quickly generate script frameworks and materials with the help of AIGC, efficiently completing the entire process practice from creativity to finished product. This “combination of learning and application” model enables them to rapidly enhance their technical application capabilities.

Secondly, the low-threshold feature of AIGC has broken through the traditional technological barriers. In the past, undergraduate students held an advantage in technology application due to their solid foundation in programming and algorithms. However, the graphical interface and modular operation of AIGC tools enable vocational college students to quickly get started without having to deeply master complex codes^[4]. For instance, through the AI painting and intelligent editing functions of AIGC, vocational college students can devote more energy to creative conception and artistic aesthetic improvement, demonstrating their personalized advantages in content creation. In addition, in the early stage of the AIGC industry’s development, more emphasis was placed on technical application capabilities and innovative thinking rather than academic background, which provided a broad employment space for vocational college students. When enterprises recruit for emerging positions such as virtual digital human design and AIGC content operation, they tend to hire talents who are proficient in operating AIGC tools and can learn quickly. Vocational college students, with their precise career positioning and practical experience, can compete on the same stage with undergraduate graduates and even demonstrate stronger adaptability and creativity in specific fields^[5].

2. Research contents

2.1. Reconstruct a new teaching ecosystem in the AIGC wave

As a teacher of the Digital Media major at Anhui Communications Vocational and Technical College, I have witnessed the disruptive changes brought about by AIGC technology to teaching. In the past, we were always troubled by the problem of “rapid tool iteration and lagging teaching”: Just after teaching students a piece of software, the industry had already updated three generations of tools. The textbooks haven’t even warmed up yet, and new technologies have already become “old knowledge”. It was not until AIGC entered the classroom that these predicaments saw a turning point^[6].

When ChatGPT became extremely popular in 2023, our teaching team keenly sensed this technological trend and proactively applied to participate in various artificial intelligence seminars and training sessions. Upon our return, we immediately set about adjusting the syllabus of teaching materials and the talent cultivation plan. Facing the explosive demand for AIGC positions and the emergence of new occupations (such as AIGC Prompt engineers, AI artists, digital content generation consultants, etc.), we actively responded to the upgrading of traditional positions (positions such as film and television post-production and UI design require mastering AI tools to assist in work). By applying AI to generate mirrors or prototypes, product images, and renderings, relevant content has been added to the courses for the 2021 graduates of the Digital Media major in advance, allowing students to become familiar with related platforms and application scenarios such as ChatGPT,

MidJourney, and HiDream. In the 2024 freshmen training program, a special course titled “The Application of AIGC in Digital Media Technology” has been set up. Now, in our graphic and image processing class, students not only retouch pictures with Photoshop but also generate creative materials with Stable Diffusion. The film and television special effects class introduces Runway ML to generate cool transition special effects with just one click. We have even turned AI tools like Doubao and KIMI into “teaching assistants”, using them to generate teaching cases and practice questions in real time, keeping the course content always in line with the cutting-edge of the industry ^[7,8].

The college level strongly supports the teaching team’s exploration and practice of new technologies:

- (1) Build AIGC LABS with high-performance GPUs and deploy localization tools to facilitate students to practice projects in AIGC LABS.
- (2) Declared the first micro-major in the application of generative artificial intelligence in Anhui Province’s higher vocational colleges, designed specialized courses for the students of the micro-major, and organized the students of the micro-major to participate in practical projects such as AIGC creative design and e-commerce advertising.
- (3) Established a deep school-enterprise cooperation with Hidream.ai, a leading domestic AIGC large model enterprise, to enable teachers and students to apply the latest AIGC large model technology in the industry at the first time, and set up an AIGC internship base in the enterprise to provide students with sufficient internship opportunities.

The transformation of teaching methods brought about by new technologies has left a deeper impression on our teaching team. In the past, when explaining 3D modeling, it took an entire class to demonstrate the operation steps, and students were still confused. Now in the AIGC training room, I can generate 3D models with skeletal bindings with just one command, and then guide students to analyze the model structure and carry out secondary creation ^[9,10]. When it came to the theme design of “Future Cities”, I led my students to generate over ten style concept images using MidJourney. We all sat around and discussed which color scheme was more tech-savvy and which composition was more visually striking. This “case demonstration + interactive discussion” model has truly brought the classroom to life.

In order to help students adapt to the industry’s demand for “short cycle and high output”, we have joined hands with Hidream.ai, a leading domestic AIGC large model company, to carry out practical project-based teaching. In the AI creative design projects that students participated in last year, some used HiDream to design the interactive interface, while others used DeepSeek to optimize the user guidance copy. Watching them grow from being unfamiliar with AIGC at the beginning to being able to skillfully combine tools to complete work, I truly felt the power of technology empowering teaching. Of course, we have not forgotten to cultivate students’ “technical immunity” either. We have specially set up an AIGC ethics discussion session in the classroom to analyze copyright dispute cases and guide students to master technology with critical thinking.

2.2. Student practice: AIGC unlocks a new track for cultivating creative designers

As a student in a vocational college, when I first entered the school, I was always worried that I was not from an art background, so I would not be able to compete with students from art colleges in design and with those from undergraduate colleges in technology. However, the emergence of AIGC has completely changed the learning trajectory of students.

Do you still remember the first class of “AI-Assisted Creation”? The teacher asked the students to use the HiDream large model to generate a “cyberpunk-style campus”. Everyone tried to input “Neon lights, floating

lane, Anhui Communications Vocational and Technical College”, and after a few seconds, a campus scene full of a futuristic feel emerged on the screen. That shock is still unforgettable to this day - it turns out that one doesn’t need superb painting skills to transform the creativity in their mind into visual works. Nowadays, when students do poster design, they first use Jiemeng to generate over ten sketches. After screening out the satisfactory composition, they use PS to refine the details. The efficiency has increased several times compared to before ^[11].

The AIGC training room has become the most beloved “creative base” among the students. In the virtual digital human project, team members collaborate and divide tasks: Some generate digital human models using Tencent Yuanbao, some handle lid-sync using Runway, and some are responsible for designing character clothing using Stable Diffusion. The short video assignment that used to take three weeks to complete can now be submitted in just one or two days, with AI automatically generating materials and creating background music. What’s even more surprising is that students can also use AI to simulate a virtual studio and practice camera language without expensive equipment. This was simply unimaginable before.

These technologies not only enhance students’ creative efficiency but also open up new horizons for their career development. Last year, our school participated in the Anhui Province College Students’ Internet Plus Competition. The H5 work on the theme of rural revitalization generated by AIGC won the second prize at the provincial level. During the preparation period, Doubao helped optimize the copywriting, and HiDream assisted in designing the interactive interface. These “intelligent assistants” gave the contestants more confidence on the competition stage. Being the first to arm ourselves with AIGC has also enabled our teacher-student team to make considerable progress. Our classmates have frequently won awards in various competitions: we have been involved in the China Computer Design Competition and the Belt and Road and BRICS Skills Competition. The anxiety of being replaced by technology has long been transformed into enthusiasm for exploring the “human-machine symbiosis” creative model ^[12,13].

2.3. Take the lead, and the future is promising

In the exploration of AIGC empowering digital media teaching, Anhui Communications Vocational and Technical College has always been at the forefront of the province. As the first higher vocational college in the province to offer a micro-major in generative artificial intelligence applications, we have taken the lead in establishing an integrated talent cultivation model of “basic courses + AIGC tool training + industrial project practice.” Since the full integration of AIGC technology into the digital media major curriculum system in 2023, more than 500 students have regularly participated in AIGC teaching practice. On average, over 100 students enter AIGC projects of partner enterprises, such as Zhixiang Future, for internships each year. Accumulate practical experience in cutting-edge fields such as virtual digital human development and AI content operation.

Through in-depth school-enterprise cooperation with the leading domestic AIGC large model enterprise, we not only introduce real project resources of the enterprise, but also jointly develop characteristic teaching materials such as “AIGC Digital Creativity Practical Tutorial”, making the teaching content seamlessly connect with industry demands ^[14]. This innovative model has achieved remarkable results: the winning rate of students in AIGC-related events in competitions such as the Anhui Provincial Vocational Skills Competition and the China Computer Design Competition has increased by 40%, and the employment rate of graduates in the fields of metaverse and virtual reality has grown by 35% year-on-year. As the first higher vocational college in the province to fully implement the AIGC teaching reform, it provides a replicable and scalable model for talent cultivation for similar institutions.

3. Conclusion

Standing at the juncture when AIGC is reshaping the educational ecosystem, the exploration and practice of Anhui Communications Vocational and Technical College not only vividly responds to the proposition of “empowering education with technology”, but also outlines a clear path for the innovative development of vocational education. From being the first to establish the micro-major of generative artificial intelligence application to building an integrated talent cultivation model of “learning, application and innovation”; From the course reconstruction that breaks down disciplinary barriers to the in-depth integration of resources through school-enterprise cooperation, the college, with the boldness of “daring to be the first in the world”, has transformed AIGC technology into a powerful driving force for cultivating future creative designers. More than 500 students have mastered cutting-edge skills through regular teaching. On average, over 100 students connect with industry demands through practical training in enterprises each year. The winning rate of 40% in competitions has risen, and the employment rate in emerging fields has increased by 35%. Behind these figures lies the innovative fruits of the resonance between education and industry.

The value of this teaching reform lies far beyond the introduction of technological tools, but more importantly, it has established a brand-new educational model of “human-machine collaboration”. Teachers have transformed from knowledge disseminators to innovation guides, and students have grown from passive recipients to creative explorers. AIGC is not only an “intelligent assistant” for enhancing efficiency but also an “inspiration engine” for stimulating imagination. When students can master AI generation technology to achieve precise creative expression and when teaching content always keeps pace with the industry’s cutting-edge, the mission of vocational education to serve industrial upgrading is most powerfully interpreted^[15].

As a benchmark for AIGC teaching reform in the province, the college’s experience has become the “spark” for the innovative development of vocational education. In the future, we will continue to deepen the integration of industry and education, explore the application boundaries of AIGC technology in interdisciplinary fields, and enable more students to find their positions and realize their value in the wave of “AI + creativity”. It is believed that with the continuous iteration of AIGC technology, the path for vocational education to cultivate high-quality skilled talents will become increasingly clear. More “future designers” who possess both technical literacy and artistic creativity will surely shine in the vast realm of the digital economy.

Funding

Teaching Research Project of the Quality Engineering in Anhui Province, “Research on an Innovative Teaching Model for Artificial Intelligence and Big Data with the Integration of Corporate Roles” (Project No.: 2022jyxm313)

Disclosure statement

The author declares no conflict of interest.

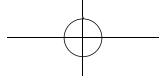
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Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.



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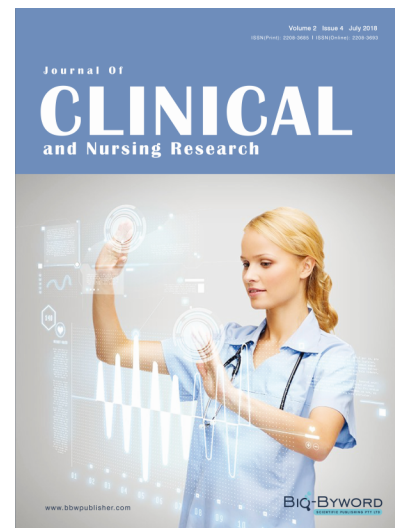
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