

- University (Natural Science Edition), 38(3): 168–170.
- [13] Xie W, Chen Q, 2017, Deepening Instrumental Analysis Teaching Reform with BOPPPS Teaching Model. *Chemical Education (Chinese & English)*, 38(18): 23–25.
- [14] Ren Y, Shao Y, Luo Y, 2014, Application of Discussion Teaching Method in Instrumental Analysis Teaching. *Education and Careers*, 2014(21): 151–152.
- [15] Qiu Q, Lv W, 2016, Reform of Teaching Methods for Chromatography Analysis Courses. *Experimental Technology and Management*, 33(7): 178–180.
- [16] Chen J, 2018, Analysis of Common Problems in Experimental Teaching of Instrument Analysis in Normal Universities and Suggestions on Teaching Reform. *Journal of Southwest Normal University (Natural Science Edition)*, 43(9): 161–164.

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Research on the Integration of Chinese Traditional Cultural Elements in Xinjiang Landscape Design

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Abstract: With the acceleration of the urbanization process and the attention of society to the ecological environment, people's requirements for landscape design are becoming higher and higher. It not only needs to meet the increasing spiritual and cultural needs of the people, but also should reflect the traditional cultural spirit and historical and cultural characteristics. China's traditional culture, after the baptism and improvement of the long time, which contains richer and deeper philosophical thoughts and values, has gradually become an important carrier in modern landscape design. This paper will focus on the analysis of the value and embodiment forms of traditional cultural elements in Xinjiang landscape design, explore their integration strategies, and provide key ways for the display of outstanding Chinese traditional culture, model culture of The Times, garrison culture and other elements, to better activate the landscape planning and design of Xinjiang region.

Keywords: Garden landscape; Traditional culture; Ecological environment; Spiritual civilization

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1. Introduction

The development history of urban garden landscape is closely related to the progress of social civilization. Landscape design not only extends the knowledge of various fields, but also integrates effectively with various excellent cultures with the development of the era, which has an important impact on the progress of social civilization. As a place where many ethnic groups live in compact communities, Xinjiang fascinates people with its unique, beautiful and diversified cultural forms. In terms of landscape design, how to skillfully integrate the excellent traditional Chinese culture with the characteristic culture of the frontier and create landscape works with both regional characteristics and cultural connotations is an urgent problem to be solved. Therefore, it is of great significance to deeply explore the application path of Chinese traditional cultural elements in landscape design for inheriting traditional culture, enriching landscape design forms and improving the ecological environment.

2. The value of traditional Chinese cultural elements in Xinjiang landscape design

2.1. It is beneficial to enrich the landscape connotation

In the context of today's rapid social and economic development, the continuous promotion of urbanization and the rapid development of tourism have injected a steady stream of vitality into the promotion of China's economy^[1]. Under the current background, people's material needs have been satisfied to a certain extent, and spiritual and cultural life has become a new goal to pursue, which is extremely obvious in the rapid development of tourism. In this process, urban landscape design has gradually become an integral and important part of the tourism field, and its social value and role have become increasingly prominent. The traditional Chinese cultural elements contain rich philosophical thoughts, artistic aesthetics and spiritual civilization, etc. By integrating these elements into the landscape design of Xinjiang, it can be endowed with deeper cultural value, historical heritage and ideological spirit, which can not only enhance the artistic quality of the landscape, but also bring people more spiritual and cultural pursuits^[2]. For example, skillfully using the techniques of borrowing scenery, matching scenery and framing scenery in traditional garden landscape can create a landscape space full of poetry and charm, making people feel as if they are in a beautiful landscape painting. Drawing on the form and decorative elements of traditional architecture, such as cornices and arches, carved doors and Windows, not only adds a strong historical atmosphere to the landscape, but also gives it unparalleled artistic value.

2.2. It is conducive to inheriting the cultural spirit

Traditional Chinese culture, as a crystallization of wisdom accumulated by the long river of history, integrates various elements such as characters, art, skills and customs. The traditional Chinese culture with rich humanistic spirit has been integrated into the spiritual blood of every Chinese, and has gradually accumulated into the complex of artistic aesthetics, cultural symbols, and civilization symbols^[3]. Garden landscape is an organic combination of artificial elements and natural art, with both the development attributes of modern buildings and the artistic characteristics of traditional culture. From the perspective of modern construction civilization, garden landscape has the functions of rest, entertainment, activities and so on. In terms of artistic aesthetic characteristics, garden landscape mainly plays the role of cultural inheritance, artistic presentation and visual transmission. The excellent traditional culture is one of the main carriers for the continuation and inheritance of China's modern civilization, reflecting the various spiritual features, values and excellent Chinese national spirit of different nations^[4]. In this regard, integrating Chinese traditional culture into the landscape design of Xinjiang can not only fully enrich the landscape design, but also convey its own cultural connotation and spirit in a better form with the help of Xinjiang landscape, so as to more effectively promote people to actively understand the ideological value and cultural concept contained in traditional culture and actively inherit the cultural spirit. For example, patriotism education base is carefully built in the garden, and the glorious deeds and lofty spirit of historical celebrities are vividly displayed, so that tourists can receive a profound patriotism education while enjoying the beautiful scenery, and stimulate the national pride and patriotic feelings in their hearts.

2.3. It is conducive to enhancing the sustainability of the landscape

In the current landscape design, some designers are influenced by Western design culture and design concept, which makes the form and aesthetic concept of landscape design relatively simple, and it is difficult to deeply integrate with traditional cultural elements^[5]. By strengthening the application of traditional Chinese cultural elements and applying them scientifically and deeply in urban landscape design, designers can innovate the landscape design style and design diversified landscape display forms from the perspective of humans and nature,

which is conducive to enhancing the sustainability of the landscape. At the same time, excellent traditional culture has always emphasized the harmonious symbiosis between man and nature, and places great importance on the protection of the ecological environment ^[6]. In the landscape design of Xinjiang, actively learning from the ecological concept of traditional culture has undoubtedly laid a solid foundation for the sustainable development of the landscape. For example, natural gardening techniques are adopted to preserve the original landforms and abundant vegetation to the maximum extent, to avoid excessive interference and destruction of the natural environment; Clever use of rainwater collection, solar energy utilization and other advanced technologies, effectively reduce landscape energy consumption and resource consumption, to achieve efficient utilization and recycling of resources.

3. The embodiment of excellent traditional culture in Xinjiang landscape design

3.1. Culture of national unity

Ethnic unity culture is an important component of China's traditional culture and an important guarantee for promoting social and economic development ^[7]. Integrating ethnic unity culture into Xinjiang landscape design can not only enhance the cohesion and feelings among various ethnic groups, but also contribute to the mutual exchange and integration of various ethnic cultures, enrich the connotation of landscape culture, and enhance the sense of identity and pride of Xinjiang people for the traditional Chinese culture. As a multi-ethnic region in Xinjiang, the culture of ethnic unity is its unique and valuable cultural wealth. In the design of garden landscape, the rich and colorful cultural customs of all ethnic groups and the beautiful atmosphere of unity and harmony can be fully displayed through the forms of architecture with ethnic characteristics, exquisite sculpture and gorgeous decoration ^[8]. For example, in the garden, carefully build the national scenery park, through the display of the traditional architecture of each ethnic group, gorgeous costumes, wonderful songs and dances, so that people can appreciate the unique cultural charm of each ethnic group; Cleverly integrating totems and iconic elements of various ethnic groups into landscape sketches not only enhances the ethnic characteristics and cultural connotation of the landscape, but also promotes cultural exchanges and unity and integration among various ethnic groups.

3.2. Symbols of historical figures

The application of traditional cultural elements in garden landscape design can not only improve the beauty of garden landscape, but also enrich the cultural heritage of garden landscape, bring people a multi-level aesthetic experience, and greatly improve the overall level of garden landscape design. The application of historical character symbols in landscape design is not only decoration, but also the inheritor of culture and the witness of history ^[9]. For example, as a cultural symbol, historical figures are deeply rooted in the streets and squares of the city, which not only beautifies the environment, but also adds a cultural richness to the city. These sculptures show the city's cultural heritage uniquely and become witnesses to history. For example, special display areas are set up in gardens to display the advanced deeds and lofty spiritual features of historical figures as role models of the era through detailed graphic introductions and multi-media displays. Vivid images and inspiring sayings of historical role models are cleverly incorporated into landscape sketches, so that while enjoying the landscape, people are deeply inspired by the power of example and thus consciously practice the core socialist values.

4. The integration strategy of traditional cultural elements in Xinjiang landscape design

4.1. Explore the connotation of traditional culture and enhance the sense of heaviness of garden landscape design

Traditional Chinese culture is the wisdom crystallized by the Chinese nation over thousands of years of historical development. It embodies the spiritual connotation of Chinese civilization and is the synthesis of cultural spirit and customs ^[10]. However, in the current field of landscape design, the invasion of Western culture makes the integration of traditional elements in landscape design and the construction of Chinese landscapes gradually less. In this regard, landscape designers need to fully realize the importance of traditional Chinese culture to the development of landscape architecture. In the face of the trend of the era and the influence of foreign culture, we should not blindly pursue the Western style of landscape design, but should integrate the excellent traditional cultural elements into the landscape design. It should be noted that before this, designers should deeply understand the traditional culture of various nationalities and extremely valuable in China, and organically integrate it with modern civilization, to innovate the form of garden landscape design ^[11]. In addition, various cultural connotations should be deeply and comprehensively explored. Through systematic research and analysis of excellent traditional Chinese culture and frontier culture, the core values and unique elements are accurately extracted to provide a rich and diverse material Treasury for landscape design. At the same time, in close combination with the regional characteristics of Xinjiang and the needs of the development of the era, the cultural connotation is creatively transformed and innovated to make it more suitable for the concept and requirements of modern garden landscape design. For example, cultural elements in Xinjiang folklore and fairy tales can be deeply excavated and combined with modern landscape design techniques to create landscape works with both traditional charm and modern flavor.

4.2. Innovate design forms to enhance the attractiveness and interactivity of landscape

Integrating traditional cultural elements into landscape design can not only protect and inherit valuable cultural heritage, but also promote traditional ancient culture to get more novel expression and living space in the modern social environment and promote its better inheritance and development ^[12]. At the same time, traditional culture is displayed through the form of garden landscape, which helps people to better understand and appreciate traditional culture, but also stimulates the interest and love of traditional culture, so as to promote the construction of a civilized society.

However, the integration of traditional cultural elements with garden landscape design is not just a simple repetition and reference, but a process of innovation and development. Designers need to combine the aesthetic concepts and needs of modern society to design more novel works. Designers can extract the essence of traditional culture, such as architectural symbols, patterns, color matching, etc., and skillfully integrate them into modern garden landscape design ^[13].

In the process of landscape design, designers should actively introduce modern advanced design concepts and cutting-edge technical means, such as digital design, virtual reality technology, etc., to enhance the innovation and sense of the era of landscape design works. Digital technology can not only help designers express and present design concepts more accurately, but also provide the public with a richer viewing experience. At the same time, designers can organically combine traditional cultural elements with modern technology. Based on retaining traditional cultural characteristics, they can cleverly integrate modern elements, such as modern materials and modern construction technology, which can make landscape works more visually novel and

profound.

For example, virtual reality technology can be used to let tourists feel the charm of ancient gardens and the innovation of modern gardens, to enhance the attraction and interaction of the landscape. For example, designers can use virtual reality technology to set up a historical memorial hall of the Xinjiang Corps in landscape design, and display the corps' development history and brilliant achievements through digital equipment, so that tourists or residents can take the initiative to understand the Xinjiang Corps culture and the heroic image and lofty spiritual style of the Corps soldiers who are fearless of difficulties, hard work and selfless dedication.

4.3. Integrate the concepts of man and nature to optimize the ecological environment

Landscape design, as the integration of natural aesthetics and the humanities, plays a vital role in modern society^[14]. It is not only the comprehensive planning of a specific space, but also the comprehensive embodiment of cultural inheritance, aesthetic expression, artistic creation and architectural design. With the continuous progress of global culture and the increasing demand of people for quality of life, landscape design is facing new challenges and higher standards. On the one hand, landscape design is not only the layout of physical space, but also the embodiment of cultural spirit^[15]. Integrating traditional cultural elements into the design can not only enhance the regional characteristics of the landscape but also promote the inheritance and innovation of culture. By applying the concepts of man and nature, combining traditional culture with modern design concepts, garden works with both historical heritage and a sense of the era are created. On the other hand, ecological protection is an indispensable part of garden design. Designers need to fully consider the characteristics of the geographical environment, rationally plan the landscape layout, and reduce the damage to the natural environment. At the same time, eco-friendly materials and advanced technologies, such as renewable materials and rainwater collection systems, are actively adopted to realize the recycling of resources and the sustainable development of the environment. The ultimate purpose of garden design is to serve the people and create a comfortable and beautiful living environment. Therefore, designers need to pay attention to the interaction between people and nature, and provide opportunities for citizens to get close to and enjoy nature by carefully creating diversified ecological landscapes, such as wetlands and forests, while promoting the comprehensive and harmonious development of urban society.

For example, local native plants can be used for landscape construction, which not only reduces the maintenance cost, but also enhances the ecological adaptability and stability of the landscape.

Xinjiang is a region inhabited by many ethnic groups, and the cultural traditions and customs of various ethnic groups provide a rich source of inspiration for landscape design. Integrating cultural elements of various ethnic groups into the design can not only show the unique charm of Xinjiang but also promote the exchange and integration between different cultures. By exploring the connotation of traditional culture, innovating design forms, and integrating the concept of man and nature, the deep integration of traditional culture and Xinjiang landscape design can be promoted, and designers can design works with very regional characteristics and cultural connotation to promote the sustainable development of landscape architecture.

Disclosure statement

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References

- [1] Bu D, 2024, Analysis on the Application of Regional Cultural Elements in Garden Landscape Design. *China Housing Facilities*, 2024(11): 34–36.
- [2] Wang B, 2024, Research on the Application of Traditional Cultural Elements in Landscape Environment Design in China. *Footwear Craft and Design*, 4(20): 141–143.
- [3] Zhang Y, 2024, Modern Expression of Intangible Cultural Heritage: Cultural Gene Translation of Lingnan Landscape Design. *New Legend*, 2024(35): 113–115.
- [4] Wang S, 2024, Case Study on the Application of Paper-Cut Art in the Teaching of Landscape Design. *Paper Making Information*, 2024(8): 120–122.
- [5] Hu Y, Peng Y, Deng Y, et al., 2024, Research on the Practice Teaching Mode of Integrating Traditional Culture into Environmental Art Design Major – A Case Study of Landscape Architecture Design Course. *Shanghai Packaging*, 2024(7): 232–234.
- [6] Zhang X, Pei B, Chen J, 2024, Research on the Practice of Blending Chinese Excellent Traditional Cultural Elements in Landscape Design. *Urban Architecture*, 21(13): 216–220.
- [7] Qiu H, 2024, Inheritance and Development of Traditional Garden Art in Modern Rural Landscape Planning and Design. *Rural Science and Technology*, 15(12): 119–122.
- [8] Luo X, 2024, Artistic Conception Construction and Aesthetic Expression of Modern Garden Landscape Based on Traditional Cultural Perspective. *Forestry Science and Technology Information*, 56(2): 213–215.
- [9] Song B, Zhang Y, 2024, Application Analysis of Chinese Traditional Cultural Elements in Modern Landscape Design. *Foshan Ceramics*, 34(5): 174–176.
- [10] Shan Q, Gao T, Wang Y, 2024, Application of Landscape Design under Regionalism Theory. *Modern Horticulture*, 47(8): 101–103.
- [11] Zhu H, Zeng J, 2024, Application of Traditional Aesthetics in Modern Landscape Design. *Modern Horticulture*, 47(5): 178–180.
- [12] Kong X, 2023, Application of Fusion of Modern Civilization and Traditional Culture in Landscape Design. *Ju She*, 2023(8): 123–125.
- [13] Han Y, 2022, Application of Traditional Culture in College Landscape Architecture Teaching from Aesthetic Perspective. *Grand Guan*, 2022(12): 126–128.
- [14] Sun M, 2022, Application Analysis of Traditional Cultural Elements Represented by Chinese Characters in Landscape Design. *Popular Literature and Art*, 2022(16): 49–51.
- [15] Jin M, 2022, Research on the Application of Traditional Cultural Elements in Modern Landscape Design. *Scientific Exploration in China*, 2022(4): 91–95.

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Research and Practice on the Interaction between Modern Educational Technology and University Physics Teaching

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Abstract: With the rapid development of information technology, modern educational technology is playing an increasingly important role in improving teaching quality and optimizing teaching models. For university physics, a basic course for science and engineering majors, teaching effect directly affects students' subsequent learning in professional courses. However, there are certain difficulties in the current university physics courses in teaching content, teaching methods, and the updating of teaching resources. It is urgently necessary to achieve innovation and transformation in the teaching model through the introduction of modern educational technology. This article explores the interactive docking mode between modern educational technology and university physics teaching, aiming to optimize the allocation of teaching resources, update teaching content, and innovate teaching methods by constructing the interactive docking links such as preview, course guidance, in-class teaching, after-class review, and testing, thereby improve students' interest and effectiveness in learning.

Keywords: Modern educational technology; University physics teaching; Interactive teaching

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1. Realistic dilemma of university physics course teaching

1.1. Slow updating of teaching content

As a fundamental professional discipline, university physics has always been in a state of continuous development and progress. New theories, experimental techniques, and research methods are constantly emerging, providing new perspectives and tools for humanity to understand the natural world. However, the update of the teaching content of current university physics courses is progressing relatively slowly^[1]. On the one hand, this is due to the need for the stability of the curriculum system. That is, to ensure that students can systematically and coherently master the basic concepts and principles of physics, the curriculum content often needs to maintain a certain degree of continuity and stability, avoiding frequent changes that may confuse students' learning and difficulties in teachers' teaching caused by frequent changes. On the other hand, the update

of teaching content requires strict examination and verification to ensure the scientific and reliable knowledge, which undoubtedly increases the difficulty and time cost of the update ^[2].

1.2. The teaching method is relatively traditional

The traditional teaching methods of university physics courses mostly focus on teachers' lectures, supplemented by blackboard or PPT demonstrations. Under this teaching mode, teachers are the main transmitters of knowledge, while students are in a passive state of receiving knowledge ^[3]. In class, teachers usually explain physical concepts, theorems, and formulas one by one according to the established curriculum and teaching plan, while students need to take notes and try their best to keep up with the teachers' explanation. This one-way of knowledge transmission leads to a lack of interaction and thinking opportunities for students in class, making it difficult to stimulate their learning interest and initiative. At the same time, in the traditional teaching models, teachers often pay too much attention to the systematicness and integrity of knowledge, ignoring individual differences and the learning needs of students. There are significant differences in the basic knowledge level, comprehension ability, and learning interest of different students. However, teachers usually adopt a "one-size-fits-all" teaching method, which cannot provide personalized guidance for each student's characteristics ^[4]. This not only limits students' learning effectiveness but also makes the classroom atmosphere monotonous and lacking in vitality.

1.3. The updating of teaching resources lags behind

In the context of the rapid development of information technology, the teaching equipment and means of university physics courses have not been updated synchronously. Some universities still rely on traditional textbooks and PPT presentations. Although these tools can meet basic teaching needs to some extent, they cannot achieve effective interaction with students ^[5]. For example, some complex physical phenomena and experimental processes are difficult for students to intuitively understand through text descriptions and static pictures. However, modern educational technologies such as virtual laboratories, 3D simulations, and interactive software etc., can provide more vivid and intuitive learning experiences. But these technologies have not been widely applied in many universities. On the other hand, the lag in the update of teaching resources is also reflected in the acquisition and management of teaching resources ^[6]. Some universities lack an effective teaching resource database. Teachers need to spend a lot of time searching for suitable teaching materials when preparing courses. This not only increases their workload but also affects teaching effectiveness. At the same time, the sharing mechanism of teaching resources is not perfect, and there is insufficient resource sharing and communication among teachers, resulting in the fact that excellent teaching resources cannot be fully utilized.

2. The design and construction of teaching interaction and docking mode

2.1. Preview and guide

In the era of "Internet +" and "Intelligence +," online course platforms and intelligent learning systems have created conditions and an environment where students can learn at any time, anywhere, and everyone can access learning resources ^[7]. In the preview stage, teachers can release preview tasks and requirements through the online platform to guide students to watch teaching videos purposefully. Students can pause and replay videos at any time to ensure a full understanding of every concept and formula. At the same time, teachers can also set up online quizzes to check students' preview knowledge, and promptly identify and solve the problems that

students encounter during the preview process. This interactive preview method not only improves students' learning enthusiasm but also enhances teachers' understanding of students' learning situations. In the course introduction stage, teachers can use multimedia teaching equipment such as projectors, electronic whiteboards, etc., to display the key content of the preview videos, and further consolidate students' preview achievements^[8]. Through this approach, complex physical phenomena and principles can be explained more intuitively, helping students establish a clear knowledge framework. In addition, teachers can organize classroom discussions, encourage students to share their gains and confusions during the preview process, and promote interaction and communication between teachers and students. This interactive teaching method can not only stimulate students' interest in learning but also increase classroom and teaching effectiveness.

2.2. Teaching in class

In classroom teaching, teachers need to transform their roles from traditional knowledge transmitters to guides and supporters of learning. In this process, teachers not only need to impart knowledge but also guide students to actively explore and practice and learn to solve problems on their own^[9]. Through various forms such as classroom discussions, group cooperation, teacher explanations and teacher-student interaction, every student can participate in the learning process, stimulate their interest and initiative. Classroom discussion is an important way to stimulate students' thinking and expression. Teachers can design some challenging and open-ended questions to guide students to have in-depth discussions. For example, when explaining electromagnetics, asking questions like "Why can electromagnetic waves propagate in a vacuum while sound waves cannot?" can stimulate students' thinking. During the discussion process, encourage students to express their own opinions, respect different views, and promote communication and cooperation among students^[10]. Through discussion, students can not only deepen their understanding of knowledge points but also cultivate critical thinking and communication skills. Group cooperation is another effective teaching method. Teachers can divide students into small groups, with each group responsible for a specific task or project. For example, when studying optics, each group is required to design a simple optical experiment to verify a certain optical principle. Group members need to divide the work and cooperate to complete the task together. At the same time, teachers need to provide necessary guidance and support to ensure that each group can complete the task successfully.

2.3. Review and quiz sessions after class

During the after-class review stage, the intelligent system can automatically recommend suitable learning resources based on students' performance in class and their practice after class. For example, for students who perform poorly in the electromagnetics section, the system can recommend more relevant videos, simulation experiments, and exercises to help them enhance their understanding^[11]. At the same time, the intelligent system can also automatically adjust the difficulty and depth of the review content according to students' learning progress, ensuring that every student can learn at their own pace. In the testing phase, artificial intelligence technology can also play an important role. Through the intelligent question generation system, it is possible to generate test questions that match the students' current learning level, which not only ensures the fairness of the test but also improves its pertinence. The intelligent grading system can quickly and accurately correct the assignments and tests submitted by students, providing them with instant feedback. More importantly, the intelligent system can conduct a detailed analysis of students' mistakes, identify the types and causes of the errors, and provide teachers with more targeted teaching suggestions for teachers.

3. The practice of teaching interaction and docking mode

3.1. Practice of innovative teaching methods

The improvement of the traditional teaching method is mainly reflected in the comprehensive optimization of the teaching content, teaching methods, and teaching evaluation system. In terms of teaching content, teachers should focus on tracking the cutting-edge developments of physical knowledge, and timely incorporate the latest scientific research achievements into teaching, and enable students to be exposed to the latest physical knowledge^[12]. At the same time, modular design of the curriculum content is carried out according to the different foundations and needs of students, diversified learning paths are provided to meet the learning needs of students at different levels. In terms of teaching methods, the traditional “cramming” teaching model is gradually being replaced by more flexible and diverse teaching methods. For example, adopting the Problem-Based Learning (PBL) mode. By raising specific questions, guiding students to explore independently, and cultivating students’ critical thinking ability and practical problem-solving ability. To improve classroom interaction, teachers can apply the flipped classroom model to combine pre-class preview with in-class discussions, allowing students to independently learn basic knowledge through watching videos, reading materials and other methods. before class. In class, in-depth discussions and practical operations are mainly carried out, which not only improves teaching efficiency but also stimulates students’ interest in learning. In terms of the teaching evaluation system, a diversified evaluation system can be established. In addition to the traditional written examination, process evaluations, such as classroom performance, group discussions, and experimental operations, should be added to comprehensively evaluate students’ learning processes and achievements. At the same time, students are encouraged to conduct self-evaluation and peer evaluation, cultivate students’ self-reflection ability and team spirit.

3.2. Teaching practice of online courses

Through the online platform, students can freely choose the learning content and engage in personalized learning without being limited by time and space^[13]. In this mode, with the use of multimedia technology, complex physical concepts and principles can be presented more intuitively and vividly, improving students’ interest and efficiency in learning. In practical operation, the design of online courses should focus on interactivity and participation to stimulate students’ learning enthusiasm. For example, setting up an online discussion area to encourage students to discuss the course content, share their learning experiences, and promote communication and cooperation among peers. To ensure the learning effect, online courses should also be equipped with sufficient auxiliary resources, such as video tutorials, simulated experiments, e-books, etc., to meet the learning needs of students at different levels. In addition, the application of artificial intelligence technology has also brought new possibilities for online course teaching. By using AI technology, it is possible to achieve intelligent analysis of students’ learning behavior, customize learning plans for each student, and provide personalized tutoring suggestions. For example, by analyzing the behavioral data of students’ online learning, an AI system can identify the difficulties and weak links in students’ learning process, timely push relevant materials, and help students overcome learning obstacles^[14]. At the same time, AI can also assist teachers in course design and provide teaching effect evaluation, thereby improving teaching quality and efficiency.

3.3. The teaching practice of virtual experiments

As an important part of modern educational technology, virtual experiments provide a new perspective and means for the teaching of university physics. Virtual experiments can not only simulate physical phenomena in reality,

but also provide complex environments and conditions that are difficult to achieve in traditional experiments, enriching students' learning experience. Introducing virtual experiments into university physics courses can effectively solve problems such as limited laboratory resources, high experimental costs, and relatively high safety risks in some experiments, providing students with a wider range of learning opportunities^[15]. In practical applications, virtual experiment platforms usually have high interactivity and operability. Students can conduct experimental operations, observe experimental phenomena, collect experimental data, and analyze them through computers or mobile devices. For example, in the study the electromagnetics, students can build circuits, adjust parameters such as voltage and current, observe the changes in the circuit, and thus deeply understand the basic principles of electromagnetics through the virtual experiment platform. This intuitive and interactive learning method helps to improve students' interest in learning and participation, and promotes the internalization of knowledge. Moreover, virtual experiments can also support interdisciplinary learning and provide students with an interdisciplinary learning experience. For example, in the context of wave optics, virtual experiments can integrate with computer graphics technology, enabling students to observe the propagation path, interference, and diffraction phenomena of light in a three-dimensional environment, thereby better understanding the basic concepts of wave optics. In this way, it can not only broaden students' knowledge but also stimulate their innovative thinking and cultivate their ability to solve complex problems.

4. Conclusion

In conclusion, the interaction and integration of modern educational technology and university physics teaching can effectively solve the problems existing in the traditional teaching mode. By introducing multimedia teaching methods and optimizing the structure of teaching content, it can effectively stimulate students' interest and improve classroom interactivity in learning. The teaching practice of online courses involved building a high-quality online teaching resource database, providing rich learning materials, and interactive platforms to help students learn independently. The teaching practice of virtual experiments uses virtual simulation technology to provide students with a realistic experimental environment, enhancing the operability and safety of experimental operations. It offers new ideas and methods for university physics teaching and has important theoretical and practical values for promoting the application of modern educational technology in university physics teaching.

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References

- [1] Wang R, Feng F, Jin C, 2022, The Teaching Model and Practice of College Physics Experiment Based on CTCL. *Journal of Science, Normal Universities*, 42(12): 98–101.
- [2] Ding Y, Gao L, Cao H, et al., 2023, Research and Exploration of Teaching Reform Based on the Integration of OBE and PBL – A Case Study of General Physics Curriculum. *Physics Bulletin*, 2023(1): 2–6.
- [3] Liu Y, Gu J, Liang C, et al., 2022, Research on the Reform of College Physics Teaching in Architecture Universities Under the Background of New Engineering. *University Physics*, 2022(1): 56–60.
- [4] Shi Z, Zhang X, 2022, Integrating Information Technology to Improve Teaching Quality: A Case Study on the Deep

- Integration of Modern Educational Technology and High School Physics Teaching. *Physics Bulletin*, 2022(S01): 126–131.
- [5] Pu Y, 2022, Application of Blended Teaching Mode in the Construction of College Physics Experiment Course – Review of College Physics Experiment Course. *Educational Theory and Practice*, 2022(6): F0002.
 - [6] Zhang L, Chen X, Gong W, 2023, Application of PBL Embedded Teaching Model in Public Basic Courses of Science and Engineering – A Case Study of College Physics Course. *Physics Bulletin*, 2023(1): 30–34.
 - [7] Zhang W, Miao Y, Chen Z, 2021, Optical Experimental Simulation Based on Python and Its Application in Medical Physics Teaching. *Modern Computer*, 2021(10): 134–136.
 - [8] Jiang T, Sun Y, Yu H, 2024, Application of Artificial Intelligence in College Physics Teaching. *Innovative Education Research*, 2024(5): 423–430.
 - [9] Wang Q, Liu J, 2021, Challenges of Organic Integration of Artificial Intelligence and Subject Teaching – Taking Physics Augmented Reality App Teaching Application as an Example. *Jiangsu Education*, 2021(17): 19–24.
 - [10] Lin X, Xie K, 2019, Current Situation of Artificial Intelligence and Rational Thinking on Its Educational Application. *Modern Educational Technology*, 2019(8): 12–17.
 - [11] Ming S, Huang R, Zhong S, 2021, Methods and Strategies for the Effective Implementation of Students' Autonomous Learning Process Under Artificial Intelligence: A Case Study of College Physics Teaching. *Physics Bulletin*, 2021(9): 4–8.
 - [12] Zheng Y, Ren W, 2023, The Path Selection of ChatGPT Teaching Application from the Perspective of Practice. *Modern Distance Education*, 2023(2): 3–10.
 - [13] Yu Y, 2023, Research on Physics Teaching in Senior High School Under Artificial Intelligence. *Navigation of Arts and Sciences*, 2023(23): 37–39.
 - [14] Zheng Y, 2024, The Educational Implication of Artificial Intelligence – Based on the Perspective of Interdisciplinary Analysis. *Modern Educational Science*, 2024(1): 20–26.
 - [15] Li S, Zheng L, 2024, Challenges and Responses of Generative Artificial Intelligence to Classroom Teaching. *Curriculum. Textbook. Teaching Methods*, 2024(1): 39–46.

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Educational Applications of Collaborative Innovation under Engineering Accreditation: A Case Study of “Digital Signal Processing”

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Abstract: This paper takes the case study of “Digital Signal Processing” to explore the educational applications of collaborative innovation under engineering accreditation. Digital signal processing is an emerging discipline that involves multiple disciplines and is widely applied in many fields. This course is the core foundational course of communication engineering, but it is highly theoretical, difficult to understand, and hard to master. To solve these issues, this paper explores teaching reform solutions from collaborative ability, creativity, classroom teaching methods, and educational philosophy to help students firmly grasp the fundamentals of science, mathematics, and engineering, meeting the demand for talent in the future engineering industry. The digital signal processing course group of Liaoning Technical University has carried out reforms and practices in several aspects, such as classroom teaching models, experimental teaching, and performance evaluation mechanisms. After three semesters of practice, the qualitative achievement of the course has increased by an average of 14.04%, and the quantitative achievement by 5.55%, indicating that the students’ interest in the course, their ability to apply the knowledge of the course, their ability to practice engineering, and their ability to work in a team have all improved greatly.

Keywords: Digital signal processing; Communication engineering; Teaching reform; Collaboration; Innovation

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1. Introduction

The digital signal processing course is the fundamental theory for the development of information science and information technology. The course primarily studies the basic principles and methods of digital signal acquisition, transformation, analysis, and filtering. The course is in a key position in the curriculum system of information talent training programs, which plays an important role in consolidating the basic theories of signal processing and cultivating students’ scientific thinking ability, engineering practice ability, and innovative research spirit ^[1].

Due to the theoretical complexity, difficulty, and challenging mastery associated with the “Digital Signal

Processing” course, it is hard for students with weak mathematical foundations, poor abstraction skills, and a lack of hands-on capabilities to comprehend and grasp, resulting in relatively poor teaching outcomes ^[2]. The primary issues with the “Digital Signal Processing” course are as follows:

(1) The teaching positioning is inaccurate

Teaching is teacher-centered, and students only passively accept learning arrangements in the teaching process, which is a typical input-oriented learning with single teaching methods and little student participation ^[3]. The traditional teaching model emphasizes the explanation of theoretical knowledge and abstract formulas, but ignores students’ needs, disregards the differences in students’ understanding ability, and only “imparts” unilaterally ^[4]. At the same time, classroom teaching mainly focuses on explaining complex and difficult formula transformations, students blindly pursue memory formulas to pass exams, and know what they know but do not know why, let alone use theoretical knowledge to solve practical problems.

(2) Teaching lacks extensibility in terms of content, time, and space, limiting how students can achieve learning outcomes

Reviewing the current teaching format, most of the teaching activities are limited to the classroom “teaching” and “learning,” with monotonous outputs that make it difficult for students to generate interest, and active participation in the learning process, therefore, students are not able to grasp the content of this course well and comprehensively.

(3) It emphasizes theory over practice

The common issues in current teaching activities are that the practical process is single, the analysis of the problem is not thorough enough, and teachers blindly “impart” knowledge without allowing students to practice, ignoring the subjective initiative of students in learning ^[5]. This classroom-bound teaching approach fails to train students to meet societal needs adequately. The course experiments involve using MATLAB programming for system analysis, signal analysis, system design, and signal filtering. This method is now widely adopted by most schools ^[6].

Comparing the teaching process of relevant courses at schools such as MIT, it is found that teachers in foreign schools explain relatively less content than in domestic universities, employing richer classroom teaching methods and playing more of a guiding role. However, foreign schools assign a larger homework load, requiring students to spend three times the classroom teaching duration to complete it, thereby significantly enhancing their self-learning and problem-solving abilities.

Digital signal processing courses are highly theoretical, tightly entwined with applications, and heavily focused on technology, which faces significant challenges in the context of traditional teaching methods: (1) The content of textbooks is out of date, it is difficult to reflect theoretical support for industry development; (2) The course’s numerous mathematical formulas and intricate deductions make it challenging for students to comprehend physical meaning, and feeling fearful of difficulties; (3) There is a disconnect between theory and practice, lacking typical engineering application cases, making it hard for students to apply what they have learned; (4) The experimental components are mainly verification-based, lacking comprehensive and extensible experimental content, and students lack innovation ability ^[7].

Various teaching teams from domestic universities have actively explored related teaching reforms in digital signal processing courses ^[8], for instance, the literature ^[9] proposes a gradual hybrid teaching model, constructing a “theoretical T + practical G + collaborative C” capability enhancement hybrid teaching system, significantly boosting students’ confidence and professional responsibility. The literature ^[10] designed a hierarchical approach

for theoretical courses, experimental courses, and course design in digital signal processing, forming an integrated learning and research teaching model. The literature ^[11] explains the importance of ideological and political education and how to integrate and implement ideological and political education in the entire teaching process. The literature ^[12] applied the hybrid flipped classroom teaching mode in the teaching of digital signal processing courses in the context of new engineering disciplines, reorganized the content of the digital signal processing course, used flipped classroom teaching to cultivate students' innovation ability, strengthened students' independent learning, and demonstrate good teaching effectiveness. The literature ^[13] integrates ideological and political education into the curriculum and designs a blended online and offline first-class curriculum for teaching on the outcomes-based education concept. Based on the education theories of outcomes-based education and conceive-design-implement-operate. The literature ^[14] is student-centered, "specialization and integration" oriented, through the project-driven and inquiry-based teaching method, to stimulate students' enthusiasm for learning, and explore students' learning potential; virtual simulation, simplifies the complexity, the abstract theory visualization, reduces the difficulty of theoretical learning, and the use of a diversified course evaluation to provide teaching and learning support. The literature ^[15] takes "strengthening the foundation, emphasizing abilities, and inspiring innovation" as the concept, benchmarking the "golden course" standard, and carrying out curriculum assessment reform from three aspects: optimizing assessment content, highlighting process evaluation, and innovating assessment methods. To give full play to students' main role, a new curriculum assessment mode combining process assessment and practical assessment is formed, to realize the curriculum's high-level, innovative, and challenging nature.

2. Key aspects of course teaching reform

2.1. Classroom teaching guided by students' needs

Reflecting on the current teaching format, students are often exposed to long lectures and blackboard-filled notes during classes, which can easily lead to fatigue, disinterest, or even aversion. Classroom teaching reform encompasses a student-centered preparatory mode before class and a teacher-guided knowledge exposition mode during class. Implement a novel, student-centered theoretical teaching reform by integrating the flipped classroom model into the educational process. Post-reform teaching focuses more on constructing students' knowledge of digital signal processing, developing their capabilities, and enhancing their qualities.

In practice, tasks are designed for pre-class, in-class, and post-class stages, and extension activities. Before class, relying on textbook reference books, fine course websites, MOOCs, and other resources, arrange pre-course study and guide students to identify problems. In-class sessions use inquiry-based teaching methods to facilitate discussion, and predetermine exploratory questions to achieve the goal of guiding students' thinking about knowledge points; Key and difficult points are discussed in seminar classes through teacher-student and student-student interactions to complete student-centered, creativity and teamwork-driven activities, effectively engaging students in learning and allowing teachers to monitor students' learning status in real-time. Post-class assignments are given to consolidate knowledge learned. By expanding the design of comprehensive project assignments, students are required to work in small groups to develop students' independent thinking, access to information, use of modern tools, communication, and expression abilities.

2.2. Integrating classroom teaching with extracurricular practice

Classroom teaching based on colleges and universities can help students establish the theoretical system of

knowledge, but cultivating the talents needed by society with practical ability needs to strengthening the practice of exercise. Therefore, it is necessary to combine theory with practice to enable students to integrate and use the knowledge they have learned.

To better facilitate students' extracurricular practice, colleges have established a multi-tiered practical teaching system, including basic practical instruction, advanced practical teaching, and project capability cultivation, and have also set up experimental classes with distinctive features to provide students with comprehensive professional practice training. An example is the acquisition of frequency conversion signals in modern communication power supplies. Pre-class tasks involve releasing the topics in advance for students to research the basic characteristics of the signals they will handle, possible filter types, parameters, and their pros and cons, and propose preliminary solutions; during class, group representatives explain the principles, content, and pros and cons of the adopted solutions, then the students and the teacher together discuss and compare all the proposed solutions and the core parameters; post-class, groups refine their approach based on in-class discussions, enhance detail handling, and summarize the knowledge points and critical issues or parameters considered in the solutions. Students can understand the actual engineering problems and develop their ability to find problems, analyse problems, and solve problems.

2.3. Using information technology to aid course teaching reform

Traditional teaching methods involve a top-down “monologue” style of teacher-student face-to-face communication. While unobjectionable from a knowledge transmission standpoint, this approach lacks interaction between students and teachers during the learning process.

With the advancement of information networks, the network, as a teaching tool, is increasingly valued by educators for its superior openness and interactivity. Teachers can create teaching videos through live streaming or recorded formats to present content more vividly and visually, facilitating students' anytime, anywhere learning. When encountering key or difficult points or knowledge points that need to be updated, teachers can offer targeted answers through live-streamed teaching, enabling students to study without the constraints of time and location, as long as they are in a place where they have access to the Internet. Additionally, an online classroom environment can be developed, including online classrooms, online homework, and online interactions, allowing students to communicate and interact with teachers outside of physical classrooms, enhancing their enthusiasm for learning.

2.4. Reform of the grading mechanism

According to the teaching needs of the digital signal processing course and referring to the teaching syllabus, a test question library including theoretical knowledge points, relevant knowledge points MATLAB implementation, and comprehensive design questions will be constructed as an effective teaching auxiliary system, forming a score evaluation mechanism that combines paper exams, classroom discussions, and project assignments.

The effectiveness of teaching reforms is generally measured by the degree to which objectives. The evaluation method for the achievement degree of course objectives includes both quantitative and qualitative evaluations. The quantitative evaluation primarily uses a weighted calculation method based on the achievement degree of course objectives, while the qualitative evaluation primarily uses a questionnaire survey method. Both types of evaluation are converted to normalized values, with both values greater than 0.65 indicating achievement of the goal and either value less than 0.65 indicating non-achievement. The total achievement value is taken as

the smaller of the two.

3. Construction of a three-dimensional hybrid teaching model

The three-dimensional fusion hybrid teaching mode is shown in **Figure 1**, which is oriented by immersive learning experiences, fully leveraging information technology tools, and utilizing the hybrid teaching of “online learning and offline teaching cycles” and “traditional teaching and digital technology complementarity” to construct a hybrid teaching paradigm that emphasizes both ideological and political elements and professional knowledge, complements theoretical learning with practical training, and combines case-guided learning with progressive cutting-edge theories.

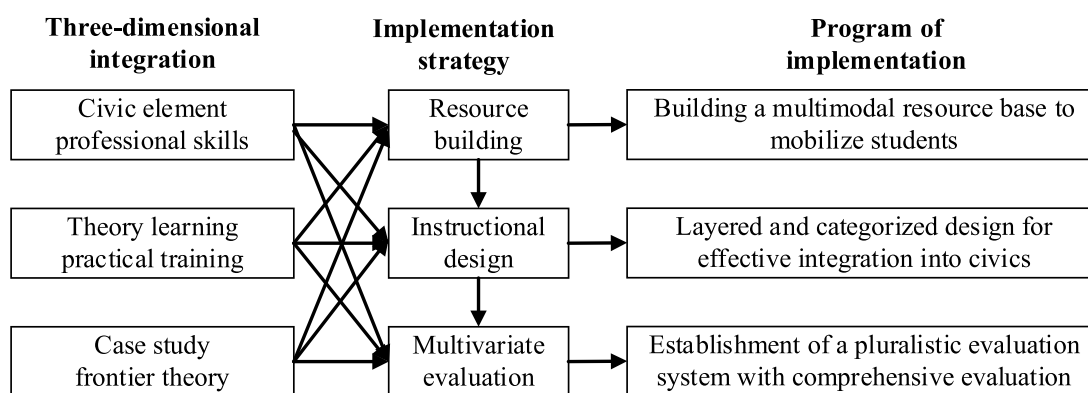


Figure 1. Three-dimensional fusion blended teaching model.

Rooted in the characteristics of the curriculum, deeply exploring ideological and political elements, finding the right fit, and achieving equal emphasis on ideological and political elements and professional knowledge. From the perspective of “cultivating virtue and nurturing talents,” grasping the requirements of professional training objectives for the curriculum, following the knowledge system of the course, and combining elements of science and technology philosophy to extract ideological components from national sentiments, scientific literacy, and humanities knowledge. These are then refined into each chapter and section, forming a knowledge map that integrates professional knowledge with ideological elements.

Design “engineering cases” around core knowledge points to learn by doing and do with learning, reflecting the complementary effect of theoretical learning and practical training. Based on the common content of “basic concepts, basic theories, and basic methods,” with the content of “practical sessions” as a bridge and the content of “typical applications” as traction, it combines the classical theories and software simulation organically; and carefully designs experimental and practical projects. The experimental and practical projects that expand on the theory are horizontally related, emphasizing the intrinsic connection between the knowledge modules, and vertically implemented, highlighting the comprehensive application of theory to realization.

Precise teaching to grasp the foundation in class, and after class, using case studies to guide knowledge expansion and understand cutting-edge theories, to realize the progression of basic content to the cutting-edge theories. The course teaching focuses on the fundamentals but also keeps up with the frontier of the development of the discipline. Based on consolidating basic theories, adding cutting-edge knowledge related to the profession, so that students can understand the latest development achievements and related application industries of the profession. Online teaching provides students with cutting-edge resource links, videos, and case studies, while also accompanied by corresponding tasks to keep up with the times in learning professional knowledge.

4. Practice of three-dimensional fusion hybrid teaching reform

4.1. Multidimensional resource construction

Using information technology such as images, animations, audio, and video to reshape course content, providing three-dimensional and multi-dimensional output, and constructing immersive learning resources.

By focusing on teaching key points and difficult aspects, addressing students' interests, and incorporating current social hot events, constructing multi-dimensional and three-dimensional resources that integrate professional knowledge and ideological and political elements from multiple aspects such as multimedia courseware, online courses, virtual simulation, mind maps, and WeChat public platforms.

Introduce three-dimensional demonstration animations for formulas and theorems that students find difficult to understand, and combine them with independently produced interactive animations to break them down, transforming stillness into motion and simplifying complexity. Core knowledge points are exemplified through typical engineering cases, closely combining abstract algorithms with real-life scenarios, facilitating theory-to-practice transitions, and enabling students to perceive that digital technology is pervasive in modern life and to apply their learning effectively.

Utilizing the Rain Classroom platform to establish online courses, corresponding online resources are established based on the learning situation, including micro course analysis, online discussions, unit tests, practice and expansion, and multiple modules.

Introducing principle demonstration and algorithm simulations to enhance student interest while reducing learning difficulty. The principle demonstration dynamically presents the signal operation process, emphasizing the physical meaning behind the formula and laying the foundation for engineering applications. Algorithm application is divided into three parts: foundation, design, and expansion. Students can process real signals through simulation to meet the personalized learning needs of students at different levels.

Learn and build together with students, and create the course's official account "Xiao Dai Signal Processing", featuring modules for program practice, engineering cases, and experience sharing. The experience-sharing module includes excellent practical examples and competition experiences from students in the major, which are reviewed and published by teachers. This aims to foster sharing and mutual assistance among students through online interaction, establishing a sustainable platform for learning and communication.

4.2. Tiered and categorized teaching design

The design of hybrid teaching directly affects the synergy among teaching elements, thereby influencing the effectiveness and quality of teaching. At the micro level of learning design, the process starts by reinforcing goal setting, guided by three sub-questions to determine core objectives: What is the most crucial content of this lesson? What do students most hope to achieve? Where are the key difficulties in student learning? Next, how to stimulate students' interest in learning and enhance their subjective initiative is considered. For this purpose, course resources are sorted, and teaching is designed in layers and categories according to the needs of online and offline teaching objectives. Online activities focus on autonomous learning by students, integrating brainstorming and quick-response segments to create a real-time interactive atmosphere that engages learning interests. Offline activities leverage the Rain Classroom, focusing on teacher analysis of key points and student-teacher interaction to clarify doubts and guide thinking. In terms of content, application cases lead the teaching, managing the theoretical-cognitive-practical-collaborative progression, layered teaching deepens understanding, guiding students into immersive learning, and weaving the intangible ideological soul into tangible professional knowledge, transforming the classroom not only into a stage for imparting knowledge but

also a venue for value-led education. Innovation and application of teaching tools. With the rapid development of Internet technology, people's lifestyles and production methods have undergone significant changes. In this context, traditional classroom teaching methods and approaches struggle to meet the diverse educational needs. Therefore, multimedia resources can be integrated into classroom teaching, and online classroom models used for extracurricular teaching, aiming to help students effectively master the course.

4.3. Dynamic multifaceted teaching evaluation

Relying on the platform of "Teaching Online," the "N+1" assessment is implemented to form a comprehensive and precise evaluation system to promote learning through evaluation. A multi-dimensional, comprehensive and dynamic evaluation system is an indispensable part of teaching, and it is also a powerful tool to guide and motivate students to actively learn and participate in the teaching process. The course adopts the "N+1" assessment format, where N is process evaluation, and 1 is summative evaluation, both of which are weighted according to 60% and 40% to get the final grade. Process evaluation is the usual diversified assessment, including homework, classroom performance, online practice, major assignments, and stage assessment. It comprehensively assesses students' learning attitude, learning engagement, learning effectiveness, practical ability, and collaborative awareness. Online and offline teaching each account for 50%, with online classrooms mainly referring to students' online video learning duration, learning frequency, participation in discussions, etc. Considering the differences in students' foundations, especially for students with relatively weak foundations, this method can improve their learning enthusiasm and participation.

In the case of communication engineering students, according to the distribution of objective achievement degrees, there is a significant improvement in students' academic performance from 2019 to 2023. From qualitative indicators: The achievement degree of Goal 1 in the 2020–2021 academic year has increased by 12.75% compared to the 2019–2020 academic year; The achievement degree of Goal 1 in the 2021–2022 academic year has increased by 18.55% compared to the 2019–2020 academic year; The achievement degree of Goal 2 in the 2020–2021 academic year has increased by 10.64% compared to the 2019–2020 academic year; The achievement degree of Goal 2 in the 2021–2022 academic year has increased by 20.42% compared to the 2019–2020 academic year. Compared to the 2019–2020 academic year, the achievement rate of Goal 3 in the 2020–2021 academic year has increased by 9.68%; The achievement of Goal 3 in the 2021–2022 academic year has increased by 14.28% compared to the 2019–2020 academic year. The proportion of each goal achievement degree to the total achievement degree is 0.35, 0.45, and 0.20, respectively. Based on this, it is calculated that the total achievement degree of the 2020–2021 academic year has increased by 14.04% compared to the 2019–2020 academic year, and there is a significant improvement in qualitative indicators. From quantitative indicators, the total achievement degree of the 2020–2021 academic year has increased by 5.55% compared to the 2019–2020 academic year. This indicates that through curriculum reform, students have achieved a certain degree of improvement in their mastery of course knowledge. Convert both evaluations into normalized values, and take the smaller value of the two to form the overall achievement degree. As shown in **Figure 2**, it can be seen that the student's course achievement degree is increasing year by year.

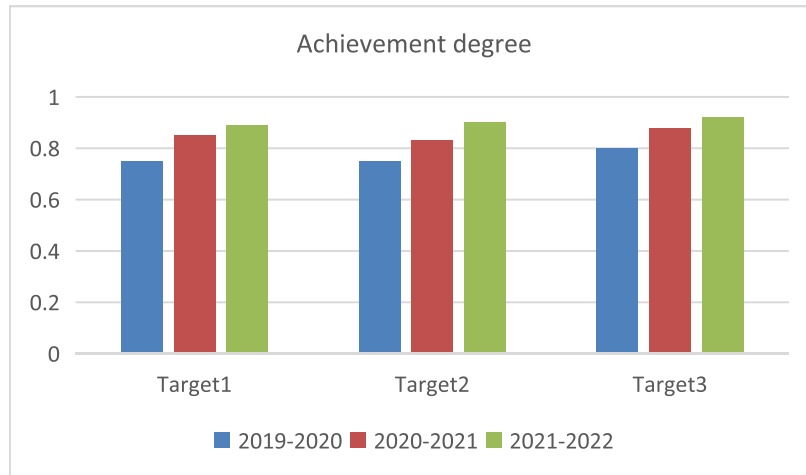


Figure 2. Achievement degree.

The final assessment, or end-of-term test, consists of comprehensive subjective questions that assess students' ability to analyse, solve, and design for discrete-time signals and systems, focusing on students' ability to integrate, actively learn, and analyse and solve problems.

To precisely assess students' specific mastery during learning and to facilitate continuous improvement, under the guidance of professional accreditation, process, and final evaluations are aligned with four graduate requirement indicators supported by the course. These are processed and analysed by the "Dai Math Easy" big data evaluation system developed by the team, allowing for precise tracking of each student's achievement of various indicators, thus achieving precise, multifaceted, and dynamic evaluations that provide direction and ideas for continuous improvement in resource construction, teaching design, and teaching implementation. **Table 1** shows the evaluation methods and value ratios corresponding to professional accreditation indicators.

Table 1. Professional accreditation indicators corresponding to evaluation methods

Course Objective	Support Requirement	Classroom Performance	Online Homework	Computer Lab	Network Evaluation	Practical Report	Homework After Class	Value Ratio
1	1.4	10	0	0	5	0	10	25
2	2.1	0	10	0	5	0	10	25
3	3.2	0	0	20	0	0	10	30
4	4.1	0	0	0	0	10	10	20
Total		10	10	20	10	10	40	100

5. Collaborative and innovative

Teachers must find long-term solutions in an engineering context when disseminating knowledge, and students must react to the teaching process, integrating personal development with actual professional growth.

For example, when conducting the "EEG signal acquisition" project in the lab, students can be organized to practice collection methods, display original noisy ECG signals, summarize problems, and execute experimental plans to cultivate their learning ability, help them integrate professional knowledge, develop new methods continuously, and maintain an open attitude towards new ideas and the unknown.

This training is expected to enable students to gradually master the skills and knowledge of discovering problems, thinking about them, seeking methods, and drawing conclusions through questioning and guidance etc. In the process of observation, discovery, thinking, debating, experiencing, and comprehending. In addition, the use of inquiry-based teaching enables students to actively participate and play a leading role in teaching activities, helping them taste the joy of their discoveries and a strong desire for knowledge and creativity.

In specific implementation, students may be asked once or more to practice arousing questions that the instructor may ask individually or in groups during class, lasting from 30 seconds to 3 minutes, questions that may include: (1) Outlining problem-solving strategies; (2) Drawing a flowchart for the just-described process; (3) Beginning to solve the problem, seeing how many questions can be resolved in two minutes; (4) Proving or verifying results; (5) What concerns or questions you have.

Engineering fundamentally involves cooperation among individuals with diverse backgrounds, capabilities, and responsibilities. Understanding others' needs and considering multiple perspectives in decision-making epitomizes the essence of teamwork. University students are notably deficient in this recognition; thus, helping students become independent learners is not the endpoint of educational training.

In the cooperative learning teaching model, students expand their knowledge acquisition channels by exchanging ideas and experiences with each other, which stimulates inspiration and active thinking. Through cooperative discussions and learning, students inspire each other within the group, deepening their understanding of knowledge and enhancing their summarization and expression abilities. At the same time, turning individual competition into group competition, using the overall performance of the group as the basis for assessment, forming a new pattern of "members within-group cooperation, members between groups competition". This enables students to communicate with each other, respect each other, and share the joy of success together, promoting their comprehensive development.

At present, group learning has not been implemented in the "Digital Signal Processing" course, but it is anticipated that students will be arranged to complete some projects in groups while the experimental course reform mentioned above is underway. The collaborative and cooperative reform plan proposed in this paper will specify more detailed requirements for grouping methods: (1) Ideal team size is 2–3 people to reduce the likelihood of domination by one person in two-person teams and to prevent exclusion in larger groups. (2) Teams should be determined by teachers, who are generally more apt at forming teams than students themselves. When students form their teams, top students often choose each other, leaving others to arrange themselves, which is unfair. Ideal teams consist of members with different capabilities, common interests, and available times. (3) Assign and rotate team member roles, essential roles include the team leader (for breaking down structures), the recorder (for documentation), and the inspector (for implementing solutions).

During the course, roles should be rotated so each student experiences different roles. Role-playing can help stimulate students' interest in learning and participation enthusiasm.

6. Conclusion

Based on long-term frontline teaching experience, to discuss the reform plan for the core course "Digital Signal Processing", starting from improving teaching effectiveness and cultivating talents needed by society. Considering the needs of the communication engineering discipline and industry development in our country, taking industrial development needs as the starting point, the reform emphasizes the combination of practical and application, setting new goals and requirements for teamwork abilities.

Based on the existing teaching situation of this course, several important factors in the reform process are discussed, and a general reform framework and a defined reform plan are proposed to provide a reference for the actual teaching reform. Theory combined with practice, through reform and development, put forward a kind of education and teaching mode that can stimulate students' interest in learning and cultivate them to become engineering talents who meet the development needs of the industry. Some of the reform ideas in this paper have been applied to current teaching and learning activities, including focusing on inspiring students' interest in learning and critical thinking, which have already yielded positive teaching outcomes and favourable feedback ratings from students. However, collaboration and creativity are difficult to quantify because these concepts are not singular or defined within science, but are not easy concepts to understand. The series of reform measures for the "Digital Signal Processing" course will be implemented in the following years, and their effectiveness needs to be further improved.

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Jiang H, Xu Y, Cheng Y, 2022, Reform and Exploration on Teaching Objectives of Digital Signal Processing. *Education and Teaching Forum*, 8(35): 69–72.
- [2] Chen X, Yao Z, Song H, 2024, Design and Practice of Progressive and Innovative Experimental Programs for Digital Signal Processing Course. *Heilongjiang Education (Research and Evaluation of Higher Education)*, 2024(5): 64–66.
- [3] Zhao Y, Zhao P, Lu J, 2023, Research and Practice of Mixed Teaching Models for Digital Signal Processing. *China Education Society of Electronics*, 2023(2): 77–78.
- [4] Dong M, Ma L, Zhu Z, et al., 2023, Student-Centered Blended Teaching Mode Exploration for Digital Signal Processing. *Journal of Electrical and Electronic Education*, 45(5): 144–146.
- [5] Dong T, 2022, The Current Situation of Blended Learning in Colleges and Universities and Suggestions for Improvement. *Western China Quality Education*, 8(22): 138–141.
- [6] Yan N, Dai C, 2023, Design of Simulation Experiment Platform for Digital Signal Processing Course Based on MATLAB. *Information and Computer*, 35(2): 221–223.
- [7] Huang Q, Lu G, Yang H, 2023, The Exploration and Practice of First-Class Course Construction in Digital Signal Processing. *Journal of Electrical and Electronic Education*, 45(1): 46–49.
- [8] Tian Z, Gao S, Chan X, 2025, Construction of Engineering Creativity and Craftsmanship Training Model for Applied Undergraduate Engineering Talents. *Education Reform and Development*, 7(1): 100–106.
- [9] Wang Y, Zhang X, Zhang L, 2020, Exploration and Practice of Implementation of Gradual Blended Teaching Mode by Taking "Digital Signal Processing" Course as Example. *Experimental Technology and Management*, 37(12): 244–249.
- [10] Ma L, Shi Y, Yuan H, 2023, Research on Hierarchical Course Teaching Design of Digital Signal Processing. *Education and Teaching Forum*, 25(6): 67–70.
- [11] Yu Y, Li L, Ou Y, 2023, Exploration of the Ideological and Political Elements in the Course of Digital Signal Processing. *Journal of Electrical and Electronic Education*, 45(5): 86–89.

- [12] Zhang T, Chen H, Liao Q, 2024, Practical Exploration of Blended Flipped Classroom—Taking the Course of “Digital Signal Processing” as an Example. *The Guide of Science & Education*, 2024(3): 104–106.
- [13] He F, Jiang D, Chen H, 2024, Research on the Teaching Design of Blended First-Class Courses Based on the OBE Concept—Taking Digital Signal Processing Course as an Example. *University Education*, 2024(6): 39–41.
- [14] Ji P, 2024, Teaching Research of Digital Signal Processing Course Based on “The Integration of Innovation and Profession.” *Journal of Jilin Agricultural Science and Technology University*, 33(1): 110–115.
- [15] Jiang H, Xu Y, Cheng Y, 2023, Exploring the Assessment Reform of Digital Signal Processing Courses Against the Standard of “Gold Class.” *Journal of Higher Education*, 9(16): 130–133.

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Teaching Innovation Practice of “Cultural and Creative Product Design” Course in Applied Universities - A Case Study of Qingdao City College

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Abstract: “Cultural and Creative Product Design” course is a first-class course in the school. Based on our school orientation of cultivating high-quality applied talents, this course aims to integrate knowledge and action. By analyzing the course objectives and pain points, it introduces a project-style teaching method, combines the innovation of six teaching methods and the improvement of a six-step teaching implementation strategy, and makes students’ cultural and creative works form an effective conversion from classroom to market to realize the beautiful vision of serving and empowering the city.

Keywords: Cultural and creative products; Teaching innovation; Teaching strategy; Practice

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1. Introduction

Cultural and creative products have attracted much attention in today’s society, and have received more and more attention and favor from people of different ages and different occupational types. In the national 14th Five-Year Plan, the integration of culture and tourism has been repeatedly mentioned as a key national development strategy. Promoting the deep integration of cultural and creative industries and tourism industries, promoting coordinated development, improving the cultural connotation of tourism products, and promoting the protection and inheritance of cultural heritage are the key directions of future urban development and planning^[1]. In accordance with the requirements of the national guidance, the characteristics of the era and the needs of the people, the design majors of major universities have offered courses on cultural and creative product design, so as to train high-quality designers of cultural and creative products. Based on the orientation of our school and the

vision of cultivating high-quality applied talents, serving and empowering the city, the Visual Communication design major offers cultural and creative product design courses. Through six teaching innovation methods and six-step teaching implementation strategies, students can combine theory and practice to achieve the unity of knowledge and action, thus greatly improving the teaching effect.

2. Curriculum objectives and pain points of “Cultural and Creative Product Design” of our school

Cultural and Creative Product design is a required course and a core course for our school's undergraduate major in Visual Communication Design. In the setting of this course, the overall goal is to cultivate high-quality applied talents. According to the talent training requirements of “strong practice, seeking innovation, serving the city and empowering the city”, the following course objectives are set:

- (1) Ideological and political objectives: to establish the correct value orientation with the new and rigorous ideological and political concepts, and to explore the elements of vivid and effective education. Thinking and politics should be new, advancing with The Times, emphasizing the core issues of contemporary society, and adding the concept of caring for the environment and caring for biology in the design. It also emphasizes the combination of theory and practice to cultivate students' practical ability and social responsibility.
- (2) Knowledge goal: Master the eight features and six design principles of cultural and creative product design, understand the value of cultural and creative products and product types, and be able to analyze, criticize and comment on the current situation and development trend of the industry, and express them in a standardized way.
- (3) Ability objective: To improve students' ability of cultural research, pattern extraction and product design, cultivate students' ability of creative thinking and artistic expression, master the design methods of cultural and creative products, and be able to complete the production of models of cultural and creative products with the knowledge learned.
- (4) Ideological and political goals: Explore students' awareness of independent learning and lifelong learning, establish cultural self-confidence, and cultivate a sense of responsibility and rigorous work attitude.

According to the investigation and analysis of the curriculum output of previous students and the interview of student representatives, there are still a lot of pain points in curriculum construction. As for the curriculum, our problem lies in the disconnection between theoretical knowledge and practical ability, which fails to achieve effective integration and cohesion. For students, the problem is that they have low participation in class and weak main body status in project work. In ideological and political aspects, the problem is that the mapping point of ideological and political content in the past course is weak, and the effective combination point of cultural confidence into teaching has not been explored.

3. Innovation of teaching methods of the “Cultural and Creative Product Design” course

The course broke through the traditional teacher-based teaching, and introduced “case-based teaching” and “project-driven teaching”. In the teaching practice of the course of cultural and creative product design, we take

the integration of knowledge and action as the teaching guidance, and the key to realizing this is to combine theoretical teaching with practical operation closely ^[2]. The Outline of the National Medium and Long Term Education Reform and Development Plan (2010–2020) clearly states that education should pay attention to the unity of knowledge and action, that is, education and teaching should be combined with productive labor and social practice ^[3]. Cultural and creative courses not only systematically teach theoretical knowledge such as design principles, cultural theories and market trends, but also pay more attention to integrating this knowledge into practice. On the one hand, through the cooperation with practice bases such as Lover Ba and Jimo Museum, students' works can be directly marketed, and the market acceptability of designs and the practicability of products can be tested through sales. This process not only realizes the direct transformation of design results but also allows students to experience the complete chain from creativity to product to market feedback, enhancing practical ability and market sensitivity. On the other hand, students are organized to conduct field visits to museums and art galleries, deeply explore the characteristics of traditional culture and patterns, deepen their understanding of excellent traditional Chinese culture, stimulate design inspiration, integrate traditional elements with modern design concepts, and create cultural and creative products that meet modern aesthetic values.

The biggest highlight of the teaching innovation of this course is to put forward six teaching methods, which are multiple teaching modes, digital enabling creativity, mixed events, three-dimensional assessment mechanisms, disciplinary integration practice, and new living ideological and political concepts, as follows ^[4].

3.1. Multiple teaching mode

The multi-teaching mode includes mixed teaching, multiple scenes and multiple teachers. Mixed teaching integrates online and offline teaching methods, and uses multiple tools such as learning Channel to publish preview materials and course videos. Padlet, as a creative exchange platform, encourages students to share design inspiration in class, while Miro and other online collaboration tools are used to realize real-time sharing and remote collaboration of class design sketches. Through the establishment of a knowledge graph, the core elements and knowledge points of cultural and creative product design course are systematically sorted out. The multi-teacher teaching mode integrates the academic theory of the school tutor and the practical experience of the enterprise tutor to build a comprehensive learning environment. Scene diversification is a key strategy to enhance students' practical ability and innovative thinking. Through design study, students can experience diverse cultures, environments and art forms, and exercise their observation and analysis skills ^[5]. Enterprise visits enable students to intuitively understand the production process, market demand and consumer psychology of cultural and creative product design, promote the integration of theoretical knowledge and practice, and improve problem solving ability. In addition, lectures and workshops build a bridge of interaction with experts in the industry, so that students can learn the cutting-edge concepts and technologies of cultural and creative design, and comprehensively improve their professional quality and comprehensive ability ^[6].

3.2. Digital empowers creativity

The teaching innovation of the course of cultural and creative product design lies in the close integration of technology and creativity, using Photoshop and Illustrator for image processing and vector design, 3D printing technology for 3D model production, and AR/VR technology to provide an immersive experience ^[7]. ^[7]These technologies not only help students transform creative ideas into realistic product renderings and solid models, but also promote the multiple integration of design elements and the exploration of material colors. Students can translate theoretical knowledge into practical results and deepen their understanding and mastery of design. In

addition, cultural and creative products made using these technologies are more competitive in the market and can meet the diversified needs of consumers.

3.3. Competition integration drive

This course is competition-driven and combined with the real design needs of enterprises. In order to cultivate students' cultural literacy required for cultural and creative design, teachers also pay attention to the combination of theory and practice, combined with the "14th Five-Year Plan" for local development, and integrate regional cultural resources into the course project to guide students to explore and solve practical problems^[8]. This course relies on the cultural and creative studio platform to carry out practical project design with Qingdao Kaiming Painting Academy, Jimo Museum and Qingdao Lover Ba Wind Scenic spot. In the project-style teaching, students' active participation in the whole design process is emphasized. By organizing students to visit the actual workplace and sharing online lectures by industry professionals, teachers can broaden students' horizons and stimulate students' interest in this course^[9].

3.4. Three-dimensional assessment mechanism

Establish a comprehensive assessment standard and indicator system, including knowledge mastery, practical ability, innovative thinking, teamwork, etc., to ensure a scientific and fair assessment. In terms of course management, the division of responsibilities for each teaching link should be clearly defined, and detailed teaching plans should be formulated to ensure the progress and quality of the course. The assessment includes process assessment, summative assessment, enterprise participation assessment, and student feedback mechanism. Process assessment refers to the introduction of daily learning tasks and periodic assessments, such as classroom questions, case analysis, periodic reports, etc. The summative assessment is designed to design a summative assessment such as a final report, project report and work presentation to ensure that students can demonstrate their comprehensive learning results at the end of the course. Enterprise participation assessment is the introduction of enterprise mentors or industry experts to participate in student assessment, especially in the evaluation of practical projects. The enterprise mentors will evaluate students' work from the perspective of market practice to help students better understand the market needs^[10]. Student feedback mechanism: students will have regular discussions and constantly improve course content and teaching methods through student feedback, to ensure the effectiveness and foresight of course management.

3.5. Discipline blending practice

Visual communication design is a discipline that emphasizes image thinking and personality creation, integrating multi-disciplinary knowledge^[11]. This course emphasizes interdisciplinary integration, mainly involving design, marketing, culturology, technology, psychology and other disciplines. For example, it integrates with design, covering visual communication, industrial design, user experience and other branches, to improve the design quality and market competitiveness of cultural and creative products^[12]. Depending on the specific type and market demand of cultural and creative products, it may also be integrated with sociology, anthropology, digital media technology (covering 3D printing, virtual reality, augmented reality and other technical means, providing more possibilities for the design and production of cultural and creative products) and other disciplines.

3.6. New and realistic ideological and political concepts

With the new and rigorous ideological and political concepts, we should establish a correct value orientation and

explore the elements of vivid and effective education. Thinking and politics should be new, keep pace with The Times, and emphasize the core issues of contemporary society. For example, through the “Garden of the Gods” and other classroom cultural and creative design cases, the concept of helping plants transmit the value of life is conveyed; The introduction of curriculum thinking and politics in a silent way helps students understand that caring for the environment and caring for organisms is the concept of caring for ourselves, so that they can be kind to nature from the bottom of their hearts and live in harmony with nature. Pay attention to the application of theoretical knowledge to practical problem solving, and cultivate students’ practical ability and social responsibility. In addition, students should be rigorous and standardized when designing, and pay attention to cultivating students’ logical thinking and critical thinking ability. Ideology and politics run through the whole process of teaching in order to achieve the best effect of ideological and political education.

4. Improve the teaching strategy of the “Cultural and Creative Product Design” course

Combined with the innovative method of the “Cultural and Creative Product Design” course, this course has also improved the specific teaching implementation strategy, and carried out the innovation of the six-step teaching implementation strategy: pre-class introduction, goal setting, interactive discussion, knowledge transmission, in-depth research, summary and review.

4.1. Pre-course introduction and goal setting

The curriculum introduction is designed based on the BOPPPS model. The BOPPPS model emphasizes the testing and evaluation of students’ pre-class learning effect before the start of participatory learning, and teachers give timely feedback to guide students to gradually change from passive learning to active learning, which helps teachers to fully grasp the learning situation and adjust the teaching design in time. And arrange teaching activities more scientifically and reasonably ^[13]. Before the course starts, each student is required to collect excellent cases of cultural and creative products that can impress them, and make a presentation to show them. This process aims to stimulate students’ enthusiasm for independent learning, encourage them to gradually increase their attention and sensitivity to the field of cultural and creative products in the active investigation, and lay a solid foundation for further study. At the beginning of the course, we can combine the current hot cultural issues and the trend of creative products as the starting point to introduce the course.

4.2. Interactive discussion and knowledge transfer of the course

Only cultural and creative products that can reflect their characteristics can truly meet people’s pursuit of culture ^[14]. This course is based on the actual needs of enterprises or the real topic of the competition. Students must go through a lot of research and understand the local characteristics before designing cultural and creative products. In this process, students make full use of diversified online and offline platforms and conduct in-depth discussions. Through communication and sharing within and between groups, students gather their opinions and inspirations into a PPT, which lays a solid foundation for the subsequent design work.

Then, the teacher, as the leader, sorted out the discussion results, summarized and extracted the eight features and six design principles of excellent cultural and creative works, and emphasized the regional characteristics in the design of cultural and creative products. Students applied the pattern elements of traditional folk culture with regional characteristics to the cultural and creative design, which could innovate the communication mode

of folk culture. The patterns of regional folk culture will be presented to the public with a new look, promote the combination of traditional folk culture and modern design, and bring new blood to the development of the cultural and creative industry. ^[15]On this basis, the online knowledge map is established, according to which students can deeply explore the core elements and frontier trends of cultural and creative design, and comb and review the context of cultural and creative knowledge.

4.3. Further research and summary review of the course

In the course of the course, the problems encountered by students will be answered by the enterprise tutor and the school tutor at the same time. The enterprise tutor is responsible for determining whether the product can be considered and whether the product is marketable. In order to ensure that students' cultural and creative product design is creative and close to market demand, the school tutor guides the design of software operation problems, insufficient drawing and typesetting design, and other problems.

At the end of the course, the assessment standards and index system are used to assess students' knowledge mastery, practical ability, innovative thinking, teamwork, and other aspects, and multiple assessment mechanisms are used to ensure the scientific and fair assessment.

5. Conclusion

Through six teaching innovation methods and six-step teaching implementation strategies, "Cultural and Creative Product Design" course enables students to combine theory and practice. Students learn to solve practical problems such as design, process and technology in specific projects with the help of PBL and project-based teaching methods, and have a deeper understanding of theoretical knowledge in practice. Students not only complete the design results on campus, but also have the opportunity to market the works through the channels of school-enterprise cooperation, truly realizing the effective transformation from the classroom to the market, realizing the integration of knowledge and action and achieving the purpose of greatly improving the teaching effect, and finally laying a solid foundation for empowering the future development of the city.

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Sun W, Mao J, 2024, Analysis on the Cultural and Creative Courses of Visual Communication Major in Higher Vocational Colleges under the Integration of Culture and Tourism. *Screen Printing*, 2024(4): 106–108.
- [2] Liu Y, Hou A, Zhang X, et al., 2024, Construction of Practical Curriculum System for Human Geography and Urban and Rural Planning under the Guidance of "Integration of Knowledge and Action". *Science and Technology Wind*, 2024(29): 34–36 + 64.
- [3] Yang X, Yang Z, 2019, Construction and Practice of Social Investigation Curriculum System Integrating Knowledge and Action. *Theory of Science*, 2019(10): 132–134.
- [4] Zhang W, 2024, Research on the Teaching Practice of Integrating Curriculum Ideology and Politics into Higher Vocational Mathematics under Mixed Teaching Model. *Scientific Consultation (Education Research)*, 2024(11):

111–114.

- [5] Wang L, 2014, Research on the Practice Teaching of Visual Communication Design in Hebei Academy of Fine Arts, thesis, Hebei University.
- [6] Zhou Y, 2018, Research on University–Enterprise Cooperation Innovation Practice of Visual Communication Design Major in Colleges and Universities, thesis, Hunan Normal University.
- [7] Chen D, 2023, Application Research of Case Teaching in the Course of 3D Printing Technology Application in Secondary Vocational Schools, thesis, Guangdong Technical Normal University.
- [8] Sun W, Mao J, 2024, Analysis on the Cultural and Creative Courses of Visual Communication Major in Higher Vocational Colleges under the Integration of Cultural and Tourism. *Screen Printing*, 2024(4): 106–108.
- [9] Jia L, 2024, Research on Reform Mode of Practical Teaching of Packaging Design Course for Visual Communication Design Major. *Green Packaging*, 2024(8): 19–22.
- [10] Dong X, 2010, Research on Studio Teaching Model Combining Production and Teaching in Visual Communication Design of Higher Vocational Colleges, thesis, Northwest Normal University.
- [11] Wang J, 2018, Exploration on Teaching Innovation of Visual Communication Design Major in Non-Art Colleges – A Case Study of Beijing Forestry University. *Forestry Education in China*, 36(1): 13–16.
- [12] Xu M, 2024, Research on Visual Communication Design Education under Interdisciplinary Background, thesis, Jiangxi University of Finance and Economics.
- [13] Wang Y, Duan M, 2022, Research on Online Mixed Multiple Teaching Model Based on BOPPPS Model. *Computer Age*, 2022(5): 118–121.
- [14] Hou M, 2023, Research on the Integration of Regional Culture and Cultural and Creative Product Design under the Background of Cultural and Tourism Integration. *Packaging Engineering*, 44(16): 340–342 + 386.
- [15] Han C, Guo S, 2024, Research on the Innovation of Traditional Folk Culture Patterns in the Design of Cultural and Creative Products from the Perspective of Design. *Art Education Research*, 2024(5): 96–98.

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Thought and Politics Class of English Speech Course for Business English Majors in Undergraduate Universities

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Abstract: This paper examines the significance, current status, and strategies for integrating ideological and political education into English speech courses for Business English majors in undergraduate universities. The study aims to explore how to cultivate interdisciplinary talents who are proficient in Business English, possess an international perspective, and deeply understand and practice socialist core values in the context of globalization. A series of innovative strategies is proposed to achieve the seamless integration of Business English speech skills and ideological and political education, thereby enhancing students' international influence. This research provides valuable insights for scholars studying the integration of these two fields.

Keywords: Undergraduate universities; Business English major; English speech course; Ideological and political education

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1. Introduction

In the rapidly evolving landscape of economic globalization, the ideological and political components of English speech courses for Business English majors in undergraduate universities serve as a bridge connecting Eastern civilization with the global community. These courses aim to cultivate Business English professionals with a profound cultural heritage and a strong sense of social responsibility. Teachers play a dual role as both knowledge imparters and value inspirers, embodying the principle of “moral cultivation” in higher education. The foundation of speech lies not only in language proficiency but also in the ability to effectively use English as a tool for communication. The primary objective of English speech learning is not merely to captivate an audience but to facilitate cross-cultural communication, convey Chinese perspectives, and effectively narrate Chinese stories. This necessitates the integration of ideological and political education into English speech courses, enabling students to internalize socialist core values, inherit the essence of traditional Chinese culture, and emerge as leaders who actively engage with the world.

2. The significance of ideological and political education in English Speech courses for Business English majors

On one hand, the incorporation of ideological and political elements into speech courses helps students establish a correct worldview, life, and moral values while enhancing their language expression skills. Teachers guide students in discussing topics related to national development, social issues, and international affairs, thereby broadening their horizons and fostering a sense of patriotism and global awareness. Through these discussions, students can articulate their interpretations of national policies, reflections on social issues, and insights into international relations, thereby showcasing Chinese wisdom and solutions in future business activities and enhancing their international competitiveness.

On the other hand, the ideological and political components of the course emphasize the cultivation of students' social responsibility and civic awareness. Through case studies, role-playing, and other interactive teaching methods, teachers enable students to deeply understand the ethical and social responsibilities inherent in Business English. Under the influence of these courses, students learn to uphold ethical standards in business practices and contribute to national development. This not only prepares them to excel as Business English professionals but also lays a solid moral foundation for their future careers. By addressing real-world challenges in Business English, students realize that their words and actions as future business leaders can have a profound societal impact. This awareness encourages them to pursue not only personal growth but also social responsibility, actively engaging in the field of Business English to promote social progress.

3. Current implementation of ideological and political education in English Speech courses in undergraduate universities

The integration of ideological and political education into English speech courses has garnered attention due to its unique interdisciplinary nature. However, many universities fail to clearly distinguish between ideological and political education and speech skills training, often blending the two without a structured approach. This lack of clarity, coupled with the heavy teaching burden and some teachers' limited understanding of the "curriculum ideology and politics" concept, hinders the effective implementation of this model. As a result, the positive impact of this integration on talent development is often constrained. Furthermore, some undergraduate English speech courses prioritize basic speech skills training, such as content organization, pronunciation, and intonation, while neglecting the cultivation of higher-order thinking skills like innovation and critical analysis.

4. Strategies for integrating ideological and political education into English Speech courses for Business English majors

4.1. Enhancing the ideological and political awareness of English teachers

In the context of English Speech courses for Business English majors, it is essential to enhance the ideological and political awareness of English teachers. Teachers in these courses bear the dual responsibility of imparting language skills and cultivating students with an international perspective and local sensibilities. As both instructors and role models, teachers' words and actions significantly influence students. Therefore, teachers must fully understand the importance of integrating ideological and political education into Business English speech training. This requires teachers to possess the ability to seamlessly blend ideological and political elements with English language instruction.

To achieve this, undergraduate universities can utilize online education platforms to disseminate ideological and political content, helping teachers deepen their understanding of the Party's educational principles and policies. Additionally, universities can organize professional development activities focused on ethics and morality, enabling teachers to establish correct professional and educational values. Inviting external experts to conduct lectures on integrating ideological and political education into English speech courses can also provide valuable insights. Only when teachers are well-equipped with this knowledge can they effectively guide students in using positive language to demonstrate the responsibilities of Chinese enterprises in business speeches, thereby enhancing students' speech skills, social responsibility, and national pride.

4.2. Integrating ideological and political education into a blended teaching model

With the rapid development of information technology, the field of Business English education has undergone significant changes, particularly with the adoption of blended teaching models that combine online and offline instruction. Undergraduate universities can leverage large-scale open online courses (MOOCs), small private online courses (SPOCs), and other digital platforms to inject new vitality into the integration of ideological and political education with English speech courses. This integration should not be a mere accumulation of elements but a systematic planning process by teachers, optimized through three key stages: pre-class preparation, in-class interaction, and post-class reflection.

For pre-class preparation, teachers can use online platforms to assign preview materials, such as English documentaries on global business partnerships. Students can practice imitating business dialogues and upload their practice videos for feedback. This approach not only improves students' Business English listening and speaking skills but also fosters cross-cultural communication abilities and an appreciation for cultural diversity and win-win cooperation. Teachers can also assign group tasks, such as researching challenges China faces in global business and proposing solutions, or analyzing case studies of Chinese enterprises' overseas investments under the Belt and Road Initiative.

During in-class interaction, teachers can showcase selected student speech videos, allowing the class to evaluate pronunciation, intonation, facial expressions, and body language. This peer and teacher feedback helps students identify and correct their shortcomings. After the video presentation, teachers can summarize key points to deepen students' understanding. For group tasks, students can present their findings, enhancing their information search and analysis skills.

For post-class reflection, teachers can assign topics such as "The Role and Responsibility of Chinese Youth in Global Business," requiring students to integrate international business trends and personal experiences into their speeches. Students upload their prepared content to the platform, conduct self-evaluations, and explain their reasoning. This approach enhances students' global vision and sense of mission.

4.3. Exploring ideological and political elements in teaching content

To effectively integrate ideological and political education into English speech courses, teachers should focus on embedding these elements into the core teaching content, with textbooks serving as supplementary resources. For example, teachers can use documentaries such as "Bridge Builders," which highlights cooperation projects under the Belt and Road Initiative, to deepen students' understanding of China's global contributions. When teaching "Business Speech Strategies and Skills," teachers can showcase China's achievements in areas like the green economy, digital economy, and global public health security, helping students intuitively grasp China's role in promoting global sustainable development. Additionally, integrating strategic thinking from "Sun Tzu's

Art of War” and interpersonal principles from “The Analects of Confucius” into Business English speech courses enriches the content and adds cultural depth.

4.4. Innovating teaching evaluation methods for English Speech courses

In terms of teaching evaluation, undergraduate Business English programs should adopt a multi-dimensional, dynamic assessment approach to comprehensively evaluate teaching effectiveness. Teachers should balance depth and breadth in their evaluations, considering not only the structure and language accuracy of speeches but also students’ ability to demonstrate a deep understanding of Chinese business models and their innovative applications. For example, in the course “Business English Speech and Innovative Practice,” teachers can assess students’ ability to analyze the development context and future trends of Chinese business, combining theoretical speculation with practical experience. Modern information technology can be utilized for peer voting and expert evaluations, providing a comprehensive, accurate, and scientific assessment of students’ learning outcomes and ideological growth.

5. Conclusion

This study highlights the importance of integrating ideological and political education into English speech courses for Business English majors in undergraduate universities. Such integration plays a crucial role in cultivating students’ comprehensive qualities and enhancing their international influence. By combining Business English speech skills training with ideological and political education, universities can cultivate talents who are not only proficient in language skills but also possess noble morality, a broad vision, and a strong sense of social responsibility. Educators, scholars, and stakeholders must support the development of English speech courses for Business English majors, working together to cultivate high-quality, internationally competitive Business English professionals.

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References

- [1] Gu R, 2024, Optimization, Integration, and Open Sharing of Business English Course Resources Based on Embedded Neural Networks. *International Journal of High Speed Electronics and Systems*, 2540120.
- [2] Su C, 2024, Views of ESP Learners on Code-Switching in Business English Classrooms. *Asian Journal of Education and Social Studies*, 50(11): 357–365.
- [3] Jiang L, Qu Y, 2024, Assessing Core Competencies of Business English Students in Chinese Higher Vocational Colleges. *Scientific Reports*, 14(1): 29328.
- [4] Song Z, Sahid S, 2025, Exploring Factors Shaping Intercultural Competence Among China’s College Students to Seize Global Business Opportunities: A Systematic Literature Review. *Social Sciences & Humanities Open*, 11: 101190.
- [5] Feng D, 2019, The Pathways of Ideological and Political Education Integrated Throughout Business English Curriculum from the Perspective of Fostering Virtue. *Journal of Educational Research and Policies*, 6(10): 93–96.

- [6] Cui Y, Yue S, 2024, Business English Teaching with Intelligent Assistance—Research on Case-driven and Artificial Intelligence Application Improvement. *Journal of Educational Research and Policies*, 6(10): 71–74.
- [7] Ruan W, 2024, Exploring the Reform of Practical Teaching of Business English Course for Cross-border E-commerce Majors in the Era of Digital Economy. *Transactions on Comparative Education*, 6(5): 135–140.
- [8] Wang X, 2024, A Practical Exploration on the Integration of Curriculum Ideology and Politics into Oral Business English Teaching. *English Abroad*, 2024(15): 100–102.
- [9] Deng W, 2023, The Exploration and Practice of Integrating Ideological and Political Elements into Business English Conversation Course. *English Plaza*, 2023(30): 105–108.
- [10] Yang J, Li Y, Tang M, 2023, A Study on the Status Quo and Strategies for Improving Ideological and Political Consciousness of Business English Majors in Cross-cultural Communication. *English Abroad*, 2023(13): 147–149.
- [11] Zhan Y, 2023, An Exploration of Ideological and Political Paths in Business English Courses under the Output-oriented Approach—A Case Study of Longyan University. *Hua Zhang*, 2023(2): 132–134.
- [12] Cui S, 2022, A Study on Ideological and Political Teaching of Business English Interpreting Courses under the Background of Flipped Classroom. *College English*, 2022(49): 16–18.
- [13] Liao W, 2022, The Teaching Goal and Implementation Plan of Ideological and Political Education for Business English Majors—A Case Study of Business English Reading Course. *English Abroad*, 2022(13): 92–94.
- [14] Li S, 2022, Research on Ideological and Political Teaching Reform and Practice of Business English Majors in Higher Vocational Colleges. *Intelligence*, 2022(18): 49–52.
- [15] He Y, 2022, Practice and Thinking on Integrating Curriculum Ideology and Politics into Blended Teaching of Business English Listening and Speaking. *Journal of Ningbo Open University*, 20(2): 114–118 + 128.

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Research on the Teaching Reform of College Computer Basic Courses Driven by Intelligent Technology

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Abstract: With the rapid development of artificial intelligence technology, the education sector is facing new development opportunities and challenges. As a high-ground for cultivating high-level professionals, colleges and universities play a crucial role in educational reform. This article briefly summarizes the significance and challenges of the teaching reform of computer basic courses, and proposes paths for the teaching reform of college computer courses driven by intelligent technology, hoping to promote the teaching reform of these courses.

Keywords: Intelligent technology; Colleges and universities; Computer basic courses

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1. Introduction

The Third Plenary Session of the 20th Central Committee of the Communist Party of China clearly proposed promoting the digital construction of education and enabling curriculum reform with smart technology. With the informatization development of society and the continuous emergence of emerging information technologies, the current situation of teaching computer basic courses in colleges and universities no longer matches the requirements of the industry. Therefore, promoting the reform of computer majors in colleges and universities, promoting the systematic integration of artificial intelligence with education, teaching, and learning, and enhancing the effectiveness of overall curriculum-based and comprehensive disciplinary education are inevitable ways for colleges and universities to improve classroom teaching quality and adapt to the development of the times.

2. Significance of the teaching reform of college computer basic courses

With the continuous deepening of educational reform, the teaching reform of college computer basic courses has become crucial. From the perspective of enhancing students' information literacy, by integrating cutting-edge teaching content such as programming thinking training and basic big-data processing theory, and using advanced

teaching methods such as problem-based learning (PBL) and group collaborative learning, it helps students build a complete computer knowledge system, strengthen their computer operation and information technology application abilities, and thus enhance students' information literacy, enabling them to cope with the challenges of future digital work and life with ease^[1]. As the digital transformation of industries accelerates, computer technology has become a key element in the development of various industries. Guided by the integration of industry and education, the teaching reform adopts practical teaching models such as project-driven and case-based teaching to deeply integrate the curriculum content with industry standards, cultivate students' professional skills and innovative thinking, meet the needs of enterprises for highly adaptable and innovative talents, and improve students' competitiveness in the job market^[2]. With the advancement of educational reform, the reformed courses will pay more attention to the cultivation of students' practical problem-solving and innovative abilities. By offering computer courses related to innovation and entrepreneurship and encouraging students to participate in practical activities such as software design and application development, it can stimulate students' entrepreneurial enthusiasm and innovative spirit, tap their potential in the field of scientific and technological innovation, and continuously supply innovative talents for the national innovation-driven development strategy.

3. Challenges faced by the teaching of college computer basic courses in the new era

3.1. Rapid technological upgrades and difficulty in updating textbook content

The rapid development of computer technology has brought opportunities as well as many challenges to the education field. In particular, the problem of lagging textbook content updates is quite prominent. Cutting-edge technologies such as cloud computing, big data, and artificial intelligence are emerging continuously, and the computer knowledge system is evolving rapidly^[3]. However, due to the complicated processes of compilation, review, and publication of college computer textbooks, their content is difficult to keep up with the pace of technological development. This makes it difficult for students to access the latest and most practical knowledge during their studies, which not only affects learning outcomes but may also cause students to struggle to adapt to the rapidly changing workplace environment after graduation. In addition, the rapid technological updates also place higher demands on teachers' teaching abilities. Teachers need to constantly learn new knowledge to introduce the latest technical content and cases into the classroom. This not only increases teachers' teaching burdens but also requires colleges and universities to increase investment in teacher training and teaching resource updates to ensure that the teaching quality keeps pace with the development of the times^[4].

3.2. Diverse student demands and difficulty in meeting them with unified teaching

Against the backdrop of the information age, the widespread application of computer technology has made it a key support for interdisciplinary integration. This trend has led to significant diversification in college students' demands for computer technology. Students have natural differences in cognitive abilities and interest preferences. In the field of computer learning, some students are deeply interested in programming, thinking and algorithm design in software development, while others prefer the theories and applications of cutting-edge fields such as data analysis and artificial intelligence^[5]. The traditional unified teaching model emphasizes using the same teaching content and methods for all students. Although this model has certain advantages in large-scale teaching, it is difficult to meet the personalized needs of students. For students with a weak foundation, the unified teaching content may lead to cognitive overload, making it difficult for them to effectively absorb knowledge. For students with a solid foundation, the simple repetitive content cannot fully stimulate their

learning motivation and potential. Therefore, college computer teaching needs to explore student-centered teaching models such as stratified teaching and project-based learning. By creating diverse learning situations, these models can meet the learning needs of different students, promote students to actively construct knowledge systems, and improve teaching effectiveness.

3.3. High requirements for practical operation abilities and mismatch with theoretical teaching

In the process of college computer teaching, there is an imbalance between the cultivation of practical operation abilities and traditional theoretical teaching. This contradiction restricts the output of high-quality computer talents. The characteristics of the computer discipline determine that the mastery of its knowledge system does not rely solely on theoretical memorization but requires deepening and consolidation through repeated practical operations^[6]. However, the traditional theoretical teaching model is deeply influenced by behaviorist theory, placing the focus of teaching entirely on the mechanical instillation of knowledge. Teachers dominate the output of knowledge in the classroom, and students passively receive it. This model makes the teaching process lack interactivity, greatly reducing students' opportunities for practical operations. As a result, students have difficulty combining the theoretical knowledge they have learned with practical applications, and their practical abilities develop extremely slowly. In terms of teaching resources, many colleges and universities have limited investment in the procurement and update of computer teaching equipment. The hardware facilities in laboratories are outdated and cannot meet the requirements of current industry development for computer technology. Moreover, the shortage of practical sites means that students often face problems such as competing for equipment and limited operation time during practical operations^[7]. In terms of the construction of the teaching staff, some teachers have long been confined to the campus environment, lack practical experience in front-line enterprises, and their knowledge reserves remain in the past. Therefore, they find it difficult to integrate the latest technical applications and cases in the industry into the classroom during teaching, resulting in targeted and practical guidance for practice.

4. Reform paths for higher vocational computer basic courses driven by intelligent technology

4.1. Innovating the teaching model to promote teaching reform

With the rapid development of science and technology, various intelligent technologies are increasingly being applied in the education field, driving the innovation of education and teaching. For college computer basic courses, the teaching model has also been renovated accordingly, and the online-offline blended teaching model has been widely used. This teaching model breaks the shackles of time and space, enabling students to make full use of online resources for autonomous learning and providing students with a good personalized learning experience^[8]. Teachers can also integrate high-quality teaching resources through online platforms, effectively enhancing the attractiveness and effectiveness of teaching content. However, although personalized learning gives students more autonomy, it largely depends on human decision-making and flexibility.

To further tap the potential of personalized learning, constructing a learner profile model based on artificial intelligence technology has become the key. By collecting students' learning behavior data and using algorithms such as collaborative filtering and knowledge modeling, it is possible to accurately analyze individual differences among students and customize personalized learning paths. Personalized learning based on artificial intelligence

technology has significant advantages. With data-driven and algorithms at its core, it can not only help students learn efficiently but also gradually cultivate students' computational thinking and innovative abilities according to their cognitive development laws, enabling students to develop good learning habits and promoting the more scientific and efficient development of computer basic courses.

4.2. Reconstructing the curriculum content to enhance educational quality and efficiency

College computer basic courses, as a comprehensive discipline, cover a wide range of basic computer theoretical knowledge and applied practical skills. In the teaching process, teachers make full use of massive online teaching materials, plan teaching content according to the characteristics of students from different majors, and produce this content into micro-courses. They also provide targeted extended learning materials for students at different learning ability levels to achieve the goal of differential teaching^[9]. However, implementing differential teaching often increases teachers' workloads. With the rapid development of intelligent technologies such as deep learning and machine learning, the above-mentioned dilemma has been effectively alleviated. Teachers can use intelligent technologies to accurately analyze students' needs, adjust teaching content and strategies, predict students' learning effects, identify students' knowledge blind spots, and design teaching activities accordingly. At the same time, it can also reduce teachers' unnecessary burdens.

For example, Content Technologies Inc. in the United States has applied deep-learning technology to the education field, sorting and integrating existing curriculum resources. Through this technology, various educational materials are accurately identified and rearranged to generate customized books and learning materials that meet students' needs. At the same time, with the powerful analysis ability of the technology, the originally complex and obscure learning content is disassembled into clearly structured and easy-to-understand modules, reducing the learning difficulty for students, effectively improving students' learning efficiency, and providing a successful example for the optimized utilization of educational resources. In the future, accurate curriculum content design and the construction of learner profile models will become the core elements of realizing personalized learning. This is not only an inevitable trend for the education field to adapt to the development of the times but also an important way to improve educational quality and promote the all-round development of students.

4.3. Improving teaching methods to enhance teaching quality

Classroom teaching is the main front of education. Its teaching quality is directly related to students' knowledge acquisition and ability cultivation and plays a decisive role in students' learning achievements. To ensure the teaching quality of the classroom, it is necessary to break the shackles of the traditional single-teaching model, adopt a more open, inclusive, and diversified teaching model, integrate task-based, project-based, and problem-based learning, establish an interdisciplinary joint lesson-preparation mechanism, and normalize the 'AI + X' teaching model to truly implement the student-centered teaching concept and meet students' diverse planning needs^[10]. The integration of artificial intelligence technology can break down resource barriers, integrate educational resources, achieve the optimized allocation of teaching resources, and improve teaching effectiveness. Reconstructing classroom content based on big data and optimizing teaching arrangements can ensure that teaching content keeps up with the pace of the times. At the same time, with the help of big-data technology, it is possible to accurately analyze students' learning behaviors, provide a decision-making basis for teachers, and help teachers teach precisely. This not only helps teachers better control the teaching rhythm but also enables personalized tutoring according to individual differences among students, implementing the

principle of teaching students according to their aptitudes and promoting students' in-depth learning^[11].

At present, in the context of educational reform, the reform of college computer basic teaching is also being gradually promoted. Teachers have changed the traditional teaching model and have gradually tried to apply diversified teaching methods in the classroom. Full-time teachers usually design teaching plans flexibly according to teaching objectives, course content, and students' learning situations, and choose teaching methods such as flipped classrooms, blended teaching, and case demonstrations to improve the teaching quality of the classroom. With the help of intelligent robots, AI teaching assistants, etc., teachers can organize classroom activities more efficiently^[12]. For example, teachers can innovatively implement the flipped-classroom model, set extracurricular autonomous learning goals for students, and guide students to learn independently. Teachers can spend more time on classroom discussions and answering questions, enhancing students' participation and depth of thinking. At the same time, students are encouraged to master learning methods of independent exploration and combination of learning and questioning, cultivating independent thinking abilities, improving teaching effects, and achieving the improvement of teaching quality.

4.4. Relying on artificial intelligence to improve the level of teaching management

Teaching management is the core content of school management work, undertaking responsibilities such as supervision and coordination of various links in the teaching process. How to reform teaching management and comprehensively improve the quality of education is an important issue facing colleges and universities. For college computer basic courses, the teaching method is usually collective teaching^[13]. However, students' learning foundations, interests, and acceptance abilities vary, resulting in uneven teaching effects and making educational management work rather difficult. It is difficult to achieve comprehensive coverage by relying solely on teachers' manual management, and the school's basic information system also struggles to meet the requirements of refined management. The introduction of artificial intelligence technology can achieve accurate collection and analysis of student data, help teachers understand the learning situation of students, develop personalized teaching plans, improve management efficiency, and ensure the quality and effectiveness of classroom teaching. An intelligent teaching management system based on data-driven and algorithm models can efficiently collect and process massive amounts of data information. Through this intelligent teaching management system, it is possible to accurately identify students' learning difficulties and needs, automatically generate learning suggestions, track and evaluate learning effects in real-time, provide accurate teaching support for teachers, help teachers adjust curriculum plans in a timely manner, and optimize classroom teaching designs, thus improving the quality and efficiency of teaching services. In addition, with the help of intelligent devices and intelligent processing technologies, teachers can also be assisted in handling some daily affairs, such as attendance records and homework grading, reducing their workloads and enabling them to focus on teaching innovation^[14]. This can not only build a learning database for students, facilitating teachers to access and use students' individual data information, but also, based on these data, conduct in-depth mining through intelligent systems, further improving the scientificity and effectiveness of teaching management.

4.5. Optimizing teaching evaluation to strengthen teaching effects

Teaching evaluation has multiple functions, covering aspects such as supervision, diagnosis, and feedback. It is an important means of providing a decision-making basis, improving teaching quality, and ensuring teaching effects. For college computer basic courses, the evaluation methods for teachers' teaching work include interviews, questionnaires, peer reviews, and teacher self-evaluations, showing diverse characteristics. However, traditional

evaluation methods have great limitations due to factors such as personal biases, subjective influences, and data incompleteness, resulting in evaluation results lacking objectivity and scientificity^[15]. With the development of artificial intelligence and other technologies and their application in the education field, by collecting multi-modal data such as teachers' and students' voices, facial expressions, body postures, classroom interactions, and physiological signals in classroom teaching, constructing classroom language, behavior, and emotion assessment data sets, and then using artificial intelligence technology to automatically identify and analyze these data sets, it is possible to achieve diversified intelligent evaluations of classroom teaching, promoting evaluation innovation through technological innovation. This provides new ideas and ways to solve problems such as unobjectivity, unfairness, and incompleteness of evaluations.

However, these traditional evaluation methods have certain limitations. Personal biases, incomplete data, subjective experience-based analysis by experts, and interference from non-teaching factors may all lead to evaluation results lacking scientificity, professionalism, and objectivity. With the development of artificial intelligence technology, its application in teaching evaluation provides a new way to solve the above-mentioned problems.

However, although artificial intelligence can change the traditional evaluation system and improve the efficiency and accuracy of teaching evaluation, over-reliance on artificial intelligence tools to measure people based on large-scale data-quantified indicators may also lead to a lack of comprehensiveness and depth in evaluation. It can be seen that artificial intelligence cannot be the sole criterion for teaching evaluation. We should always keep in mind that the intelligentization of educational evaluation is not for the sake of intelligence but to serve as an auxiliary tool for teachers to conduct teaching analysis and reflection. It should be deeply integrated with traditional evaluation methods to promote the reform of modern educational evaluation.

5. Conclusion

In summary, in the context of the intelligent era, the integration of technical means such as artificial intelligence with education and teaching is continuously deepening, providing various possibilities for the innovation of education and teaching methods and offering students a more convenient and intelligent teaching experience. Facing the new situation, colleges and universities, as the key positions for knowledge inheritance and innovation, should seize the opportunities of the times and promote the integration of education and teaching with modern technology. By comprehensively implementing measures in aspects such as innovating teaching models, reconstructing curriculum content, improving teaching methods, enhancing the level of teaching management, and optimizing teaching evaluation, new vitality for educational development can be stimulated, and new achievements can be made in curriculum teaching reform.

Disclosure statement

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References

- [1] Xu Y, 2024, Research on the Teaching Reform of Higher Vocational Computer Basic Courses in the Big-Data Era. *Learning Weekly*, 2024(25): 9–12.

- [2] She C, 2023, Discussion on the Hierarchical Teaching Reform of “Computer Application Foundation” Courses in Colleges and Universities. *China New Telecommunications*, 25(18): 89–91.
- [3] Yang S, 2023, Exploring the Teaching Reform of College Computer Basic Courses under the Background of “Innovation and Entrepreneurship”. *Technology Wind*, 2023(18): 58–60.
- [4] Wang W, Pang L, Xiong W, 2023, Practical Research on the Teaching Reform of College Computer Public Basic Courses in the Context of the Times. *Scientific Consult (Educational Research)*, 2023(5): 95–97.
- [5] Lin G, Zhao N, 2022, The Goal Dimensions and Realization Paths of the Teaching Reform of Computer Basic Courses in Application-Oriented Colleges and Universities. *China Information Technology Education*, 2022(16): 92–95.
- [6] Yang X, 2022, Research on the Hierarchical Teaching Reform of College Computer Application Foundation Courses. *Computer Knowledge and Technology*, 18(23): 166–167 + 180.
- [7] Li H, Tang J, 2022, Research on the Teaching Reform of Public Computer Courses for New Engineering. *Journal of Hubei University of Economics (Humanities and Social Sciences Edition)*, 19(7): 139–141.
- [8] Hu L, 2022, Research on the Teaching Reform of College Computer Basic Courses in the New Media Environment. *China New Telecommunications*, 24(13): 149–151.
- [9] Zhang Y, 2022, Analysis of the Reform of Computer Basic Courses in Preschool Normal Colleges from the Perspective of Smart Education. *China New Telecommunications*, 24(12): 125–127.
- [10] Huang J, 2022, Some Thoughts on the Reform of College Computer Basic Courses. *Computer Knowledge and Technology*, 18(17): 131–133.
- [11] Zheng L, 2021, Research on the Reform of Higher Vocational Computer Basic Courses under the Background of “Internet + Education”. *Modern Vocational Education*, 2021(52): 80–81.
- [12] Wu H, 2021, Exploration of Teaching Reform Strategies for Computer Basic Courses in Application-Oriented Undergraduate Colleges and Universities. *Computer Knowledge and Technology*, 17(34): 272–273.
- [13] Wu M, 2021, Reform of College Computer Basic Courses under the Background of New Engineering. *Educational Informatization Forum*, 2021(9): 58–59.
- [14] Fan Q, 2021, Research on the Teaching Reform of “Computer Application Foundation” Courses in Colleges and Universities Based on Big Data. *Wireless Internet Technology*, 18(14): 139–140.
- [15] Huang M, 2020, Research on the Reform of Higher Vocational Computer Basic Courses under the Background of Intelligent Education. *Guangxi Education*, 2020(43): 167–169.

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Research on the Teaching Design of Pre-school Children's Game Course under the Background of Curriculum Ideology and Politics

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Abstract: Against the background of current education reform, curriculum ideology and politics have become an important issue in the field of higher education. As an important part of preschool education specialty, the optimization and innovation of the teaching design of preschool children's game courses is of great significance for improving the professional quality of college students and cultivating preschool talents with both morality and ability. This paper aims to explore the teaching design of preschool children's game course in colleges and universities under the background of curriculum ideology and politics, and proposes a series of concrete measures by analyzing the significance, existing problems and improvement strategies of curriculum ideology and politics, to provide references for the curriculum reform of preschool education major in colleges and universities.

Keywords: Curriculum thought and politics; Game course for preschool children in colleges and universities; Instructional design

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1. The significance of ideological and political development of pre-school children's game courses in colleges and universities

1.1. Implement the requirements of the Ministry of Education on ideological and political education in institutions of higher learning

With the release of the "Guidelines of the Ministry of Education on the Construction of Ideological and Political Education in Institutions of Higher Learning," the construction of ideological and political education in institutions of higher learning has become a key link to improve the quality of education and teaching^[1]. This policy not only provides a new direction for the reform of education and teaching in colleges and universities, but also brings new opportunities for the teaching design of pre-school children's game courses. Integrating ideological and political elements into the game course for preschool children is an important measure to respond to the national policy and cultivate high-quality talents in the new era. In the course design, educators should closely combine ideological and political elements with the course content to organically integrate them together.

For example, when introducing different types of games, they can combine the socialist core values advocated by the state to explain how to cultivate children's patriotic feelings, collective consciousness, integrity and quality through games. At the same time, educators can also guide college students to think about the important role of games in children's moral education by analyzing classic cases of children's games to cultivate their sense of social responsibility and historical mission^[2]

1.2. Promote ideological and political reform of pre-school children's game teaching curriculum

Since the National College Ideological and Political Work Conference, curriculum ideological and political reform has been a hot topic in the field of higher education. As an important link to train future preschool educators, the ideological and political reform of preschool children's game courses is particularly critical. Ideological and political education can be integrated into the preschool children's game course to guide college students to establish a correct view of education, children's view and values^[3]. Educators should attach importance to children's comprehensive development, respect each child's differences, and cultivate children's innovative spirit and practical ability. At the same time, by analyzing the influence of games in different cultural backgrounds on children's social development, it can cultivate college students' cultural self-confidence and multi-cultural awareness, and lay a solid foundation for their future educational work^[4].

1.3. Improve the professional quality of college students, and practice the task of fostering morality and cultivating people

In the game course for preschool children, college students not only need to master professional knowledge and skills, but also need to possess noble moral character. Through the integration of ideological and political education, cultivate college students' professional quality and professional ethics, so that college students can become pre-school educators with a sense of social responsibility^[5]. In the process of game design and implementation, college students need to pay attention to the overall development of children, including cognitive, emotional, social and other aspects. Children's self-confidence, independence, cooperation and other qualities can be cultivated through activities such as role-playing and teamwork in games. At the same time, they need to learn to respect children's differences, pay attention to their emotional needs, personalized support and guidance, and other aspects of knowledge, which has a high professional quality and professional ethics requirements for college students, therefore, college students should have a sense of innovation and practical ability, through participating in actual game design and teaching activities to exercise^[6]. At the same time, through cooperation and communication with others, they can cultivate communication ability and teamwork spirit, and then improve their professional quality.

2. Problems existing in the thinking and politics of pre-school children's game courses

2.1. College educators have a low sense of ideological and political value of the curriculum

First of all, the original teaching plan has formed a relatively stable teaching mode and rhythm after years of practice and optimization. The addition of ideology and politics in the curriculum means that new teaching contents need to be added in the limited class hours, which not only requires college educators to redesign the teaching plan, but also requires them to complete more teaching tasks in the limited time^[7]. This extra burden

makes many college educators feel great pressure, which leads to resistance to the implementation of curriculum ideology and politics.

Secondly, some college educators believe that the main task of specialized courses is to impart professional knowledge and skills, while ideological and political education is the responsibility of ideological and political college educators^[8]. This kind of understanding leads them to be in a passive state and a lack of initiative and enthusiasm in the implementation of ideological and political education. Moreover, some college educators believe that ideological and political education and specialized course teaching are two separate fields, and it is difficult to integrate them. They worry that adding ideological and political content to specialized courses will affect the teaching effect, or even distract college students' attention and affect their mastery of professional knowledge. This phenomenon not only limits the scope of implementation of ideological and political courses but also affects the depth and breadth of ideological and political courses.

Finally, many institutions of higher learning lack systematic training and support for college educators in the process of promoting curriculum ideology and politics. College educators lack the necessary guidance and resources in the implementation of curriculum ideology and politics, which makes them feel at a loss in teaching.

2.2. Lack of guidance of ideological and political goals in teaching design

As an important support for college educators, the content and goal of teaching materials directly affect the teaching design of college educators. However, the existing textbooks fail to fully integrate the ideological and political requirements of the curriculum in the process of compiling, resulting in a lack of clear ideological and political goals for college educators in the design of teaching plans^[9]. On the one hand, the content of textbooks emphasizes the teaching of professional knowledge, but neglects the integration of ideological and political education. Many textbooks fail to fully reflect the ideological and political requirements of the curriculum when they are written, resulting in a lack of clear ideological and political goals for college educators when designing teaching plans^[10]. On the other hand, the overall planning is not enough, and the sorting is not systematic enough. When some college educators implement curriculum ideology and politics, they often integrate them into the classroom in the form of scattered knowledge points or cases, lacking overall planning and systematic combination. Such separated ideological components are difficult to form behavior, cultivation and emotional resonance in the heart.

2.3. The curriculum's ideological and political content lacks systematic

In the teaching design of the game course for preschool children in colleges and universities, some college educators often integrate the course ideology and politics into the classroom in the form of scattered knowledge points, topics, or cases, failing to form an overall plan and systematic combination^[11]. Such fragmented ideological and political elements are not only difficult to arouse the interest and emotional resonance of college students, but also difficult to form internal behavior cultivation in the minds of college students. The concrete manifestations are as follows: first, the content is fragmented. When university educators integrate ideological and political elements into the classroom, they often only pay attention to the explanation of a single knowledge point or case, and lack of organic connection with other teaching content. This fragmented teaching method makes it difficult to form a deep impression and cultivate internal behavior in the minds of college students. Second, the lack of emotional resonance. Due to the lack of systematic planning and combining, the ideological and political content is often far from the actual life and study of college students, and it is difficult to touch their hearts and trigger emotional resonance. As a result, it is difficult for college students to convert their ideological

and political knowledge into actual norms of behavior and values.

3. Promote the strategy of thinking and politics in pre-school children's game courses

3.1. Strengthen the value of ideological and political thinking and enhance the ideological and political awareness of college educators

In the context of ideological and political curriculum, colleges and universities should take the construction of ideological and political curriculum teachers as an important task, and improve the ideological and political literacy and teaching ability of college educators through various ways^[12]. First of all, colleges and universities can issue relevant policies to reward college educators who have made excellent achievements in curriculum ideology and politics, to stimulate the enthusiasm and creativity of college educators. For example, they can set up special bonuses, provide opportunities for further study, and select excellent college educators to form a good incentive mechanism and promote college educators to constantly improve their ideological and political level in the curriculum. In addition, colleges and universities should encourage and support exchanges and cooperation among college educators, and form a collaborative education mechanism among various disciplines in their specialties by carrying out curriculum ideological and political teaching and research activities. This mechanism not only helps college educators to learn from each other in teaching practice, but also promotes the integration and innovation of different disciplines. For example, seminars on curriculum thinking and politics, teaching observation courses and experience sharing meetings are held to provide a platform for college educators to exchange ideas and discuss effective methods and strategies of curriculum thinking and politics. Through these activities, college educators can keep abreast of the latest ideological and political education concepts and methods, and constantly enrich their teaching content and means. Within the same major, ideological and political elements of the curriculum should be integrated among courses, and a database of ideological and political cases can be established among college educators to realize resource sharing and complementary advantages. In this way, college educators can better integrate ideological and political elements into the teaching design of preschool children's game courses, realize the organic combination of curriculum, ideological and political, and professional courses, and improve the comprehensive quality and professional ability of college students.

3.2. Set ideological and political goals according to ideological and political requirements and teaching practice

When designing the teaching objectives, the educators of colleges and universities should take the ideological and political objectives as guidance, and ensure that the requirements of the curriculum ideological and political requirements run through all aspects of teaching. First, colleges and universities need to sort out the ideological and political goals of their professional talents training by combining the Guiding Outline of Ideological and Political Construction of Curriculum in Colleges and Universities, the Professional Ability Standards for normal Students of Preschool Education Majors (Trial), the Professional Standards for Kindergarten Teachers (Trial) and other documents^[13]. These documents provide the basic framework and specific requirements of ideological and political education. College educators need to deeply understand the spirit of these documents and clarify the ideological and political goals of preschool education.

The second is to set political and ideological goals in the curriculum standards, combined with professional personnel training programs and curriculum programs. Professional personnel training programs and course

plans are important bases for guiding teaching. College educators need to integrate ideological and political goals into them to ensure that curriculum design meets the requirements of ideological and political education.

Third, comprehensively integrate the content of teaching materials, re-integrate the teaching content, and differentiate the target requirements of political disciplines. Teaching material is an important carrier of teaching, so it is necessary for college educators to deeply analyze the content of teaching materials, find out the ideological and political elements contained therein, re-integrate the teaching content, and refine the ideological and political goals into the teaching content of each class. For example, when explaining the theory of children's games, it can be combined with practical cases to guide college students to think about the role of games in the cultivation of children's morality.

Fourth, according to the specific teaching content, design the ideological and political goals of classroom teaching. In the actual teaching process, college educators need to design specific ideological and political goals according to the specific content of each lesson. These goals need to echo the ideological and political goals in the curriculum standards to ensure that each lesson can achieve the goal of ideological and political education^[14]. For example, in the lesson "Children's Play and Social Development," the ideological and political goal can be designed as "cultivating college students' attention to and ability to solve social problems," and by discussing the impact of social play on children's social development, college students can be guided to think about how to promote children's social development through games.

3.3. Integrate teaching content and build an ideological and political system

To build a systematic ideological and political system, it is necessary to reorganize and integrate the course content to ensure that ideological and political elements can be organically integrated into it

In the teaching of professional courses, professional courses and ideological and political courses should go hand in hand and complement each other^[15]. In the pre-school children's game course, the teaching content can be integrated into three major modules, namely, pre-school children's game overview, game design and organization guidance, and game observation and evaluation. Modular design can not only systematically present the course content, but also provide a clear path for the integration of ideological and political elements. Specifically, to guide college students in the "Preschool children's game Overview" module 1, around the "teacher's ethics first, children oriented, ability oriented, lifelong learning" ideological main line, to understand the importance of games in children's growth. For example, through the analysis of different types of children's games, emphasize the ethical responsibility of college educators in game design, and guide college students to establish a correct view of children and education. In Module 2, "Game Design and Organizational Guidance for Preschool Children," ideological and political education needs to be further deepened. For example, designing children's games with different backgrounds and abilities to cultivate college students' empathy and sense of responsibility. In the module three "Pre-school children's game observation and evaluation," combined with specific observation and evaluation methods, guides college students to learn to evaluate the effect of games scientifically. By observing children's performance in games, college students can better understand children's needs and characteristics to make adjustments in game design and improve the quality of games. At the same time, it is emphasized that games are not only entertainment, but can guide college students to reflect on the value of education in games, which is an important means to promote the comprehensive development of children. Through such reflection, college students can have a deeper understanding of the important role of college educators in children's growth and further enhance their professional identity and sense of responsibility.

4. Conclusion

In short, the article first expounds the necessity and importance of curriculum ideology and politics in the field of preschool education, and emphasizes its positive role in implementing the policies of the Ministry of Education, promoting teaching reform, and improving the comprehensive quality of college students. Then, it analyzes the existing problems in the ideological and political course of preschool children's games, and puts forward some strategies, such as strengthening the ideological and political value, enhancing the ideological and political consciousness of college educators, setting ideological and political goals according to the requirements of ideological and political education and the actual teaching practice, constructing ideological and political system by integrating teaching content, innovating teaching mode and improving teaching methods. Through the implementation of these strategies, we can realize the organic integration of curriculum, ideological and political education and professional teaching, improve the teaching quality of preschool education majors, and cultivate more outstanding preschool education talents in line with the needs of the era. In this way, it not only provides a useful reference for the ideological and political reform of other related courses but also contributes to the comprehensive development of ideological and political education in colleges and universities.

Disclosure statement

The author declares no conflict of interest.

References

- [1] He Y, 2019, Exploration on the Essential Connotation and Realization Path of "Curriculum Thinking and Politics". *Journal of Ideological and Theoretical Education Guide*, 2019(10): 130–134.
- [2] Tang F, 2018, Review on the Theory and Practice of the Implementation of "Curriculum Ideology and Politics" in Colleges and Universities. *College English*, 2018(49): 65–66.
- [3] Zhou D, 2022, Analysis on Ideological and Political Construction Path of Pre-school Children's Play Course for Pre-school Education Majors in Higher Vocational Colleges. *Journal of Fuyang Vocational and Technical College*, 33(2): 26–29.
- [4] Xu F, 2022, Discussion on Ideological and Political Construction of Professional Curriculum of Early Childhood Development and Health Management – A Case Study of Preschool Children's Play Guidance Course. *New Wisdom*, 2022(30): 62–63.
- [5] Xu C, 2023, Research on Curriculum Design and Implementation of Science Education for Preschool Children Based on Multiple Intelligences Theory. *Higher Education*, 2023(34): 102–104.
- [6] Zhou Q, 2024, Research on Optimization Strategies of Picture Book Teaching Activities in Kindergartens. *World Children*, 2024(5): 108–110.
- [7] Wang X, Shen X, 2021, Exploration on Ideological and Political Practice of "Preschool Children's Health Care" Course. *Journal of Ningbo Institute of Education*, 23(6): 72–75.
- [8] Dong S, 2021, Exploration on Ideological and Political Teaching Reform of "Oral Expression of Preschool Higher Education Educators" Course for Preschool Education Majors – A Case Study of "Oral Expression of Preschool Higher Education Educators" Module. *Journal of Social Sciences, Jiamusi University*, 39(6): 242–245.
- [9] Ye S, Zhang F, 2022, A Preliminary Study on Ideological and Political Construction of Pre-education Major Curriculum in Open University – Taking "Kindergarten Organization and Management" as an Example. *Journal of*

Ningbo Open University, 20(1): 25–29.

- [10] Xu J, 2023, Research on Integrating “Preschool Children’s Health Education” into Curriculum Ideology and Politics in Colleges and Universities. *Road to Success*, 2023(32): 117–120.
- [11] Xu F, 2022, On the Ideological and Political Construction of the Curriculum for the Specialty of Early Childhood Development and Health Management – A Case Study of the Course “Pre-school Children’s Play Guidance”. *New Wisdom*, 2022(30): 62–63.
- [12] Yang J, 2021, Path Analysis on Ideological and Political Construction of Preschool Education Curriculum in Higher Vocational Colleges – Taking Preschool Children’s Behavior Observation Course as an Example. *Southern Journal of Vocational Education*, 11(3): 68–73.
- [13] Ye L, 2022, Research on ideological and political teaching in pedagogical courses based on ideological and political cases. *Journal of Yuzhang Normal University*, 37(2): 49–53.
- [14] Hu S, Shi Y, Liu X, 2024, Research on the Current Situation and Path of Integrating Curriculum Ideology and Politics into the Professional Curriculum of “Children’s Games”. *China Transition from Military to Civilian*, 2024(4): 146–148.
- [15] Zhao D, 2024, Exploration on the Teaching Design of Game Course for Preschool Children in Higher Vocational Colleges Under the Background of Curriculum Ideology and Politics. *Journal of Yunnan Open University*, 26(3): 93–97.

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Discussion on Teaching Reform and Practice of College Physics under the Background of New Engineering

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Abstract: The proposal of new engineering aims to cultivate compound talents with interdisciplinary knowledge, innovation ability, and practical ability, which puts forward new requirements for the teaching of physics courses. However, there are many problems in the current physics course teaching in colleges and universities, which make it difficult to meet the diversified professional needs in the background of new engineering. Based on this, by analyzing the specific requirements of new engineering for physics course teaching, this paper discusses the existing problems in the current college physics course teaching and puts forward the corresponding reform strategies to provide reference for the college physics course teaching reform under the background of new engineering.

Keywords: New engineering; College physics course; Teaching reform and practice

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1. New engineering background overview

In 2016, the Ministry of Education issued the “Notice on the Development of New Engineering Research and Practice,” marking the official prelude to the construction of new engineering in China ^[1]. The proposal for new engineering is not only to train engineering and technical talents with innovative spirit and practical ability, but also to promote China’s transformation from a manufacturing power to a manufacturing power, and to provide strong talent support for realizing the Chinese dream of the great rejuvenation of the Chinese nation. The proposal for new engineering also reflects the profound insight into the development trend of international engineering education. In recent years, countries around the world have put forward their engineering education reform plans, such as the “Engineering Education 2020” in the United States, the “Engineering Education Innovation Plan” in the United Kingdom, etc. The core of these reform plans is to emphasize the cultivation of students’ innovative ability and practical ability as well as the comprehensive quality of interdisciplinary ^[2]. In terms of the reform of physics course teaching in colleges and universities, under the background of new engineering, physics teaching should not only impart students solid basic knowledge of physics, but also pay attention to cultivating students’

innovation ability and practical ability. Therefore, the teaching reform of physics courses in colleges and universities should be closely combined with the goals and requirements of new engineering construction, and constantly explore new teaching concepts and methods to make contributions to the training of engineering and technical talents with international competitiveness.

2. The existing problems of physics course teaching in colleges and universities under the background of new engineering

2.1. The curriculum system is thin, and it is difficult to meet the needs of diversified majors

At present, the setting of physics curriculum often focuses on the teaching of basic theories, and pays insufficient attention to the frontier technology and practical application required by the new engineering major, which makes students lack the necessary knowledge reserve and technical support when facing practical engineering problems. At the same time, the teaching content of physics courses usually focuses on classical physics, while the knowledge of modern physics fields such as quantum mechanics, solid state physics and nanotechnology is less involved. This course setting not only fails to meet the diversified demands of new engineering majors for physics knowledge, but also limits the cultivation of students' innovative ability and practical ability in these fields ^[3]. Under the background of new engineering, students of different majors have significant differences in their demands for physics knowledge, which brings great challenges to the teaching content and methods of physics courses. On the one hand, physics courses need to cover a wide range of knowledge fields to meet the needs of students of different majors. On the other hand, the teaching content needs to have enough depth to help students apply physics knowledge to solve practical problems in their respective professional fields. However, the existing physics curriculum system is often difficult to accommodate these needs, resulting in a difficult balance between the breadth and depth of teaching content ^[4].

2.2. The teaching content is not forward-looking and contemporary

Most of the current physics course materials follow the traditional teaching content and fail to reflect the latest progress of physics in time. To be specific, some college physics courses still focus on the basic theories of classical physics, such as Newtonian mechanics, electromagnetism, thermodynamics, etc., and pay insufficient attention to the frontier fields of modern physics ^[5]. This limitation of teaching content makes it difficult for students to understand the importance of quantum mechanics in modern science and technology, let alone master related application technologies. On the other hand, the long update cycle of physics textbooks also leads to the disconnection between teaching content and practical application. Under the background of new engineering, the application range of physics knowledge is expanding constantly, from the traditional engineering field to the emerging information technology, biotechnology and other fields, all of which put forward new demands for physics knowledge. However, the existing physics textbooks focus on the traditional physics theory and lack a detailed introduction to the application of new engineering fields. It is difficult for students to flexibly apply what they have learned in the face of practical problems, which affects the cultivation of their innovation ability and practical ability.

2.3. The teaching method lacks creativity and vitality

At present, although advanced teaching technologies such as virtual reality, augmented reality, online education platforms and intelligent teaching assistants continue to emerge in the field of education, the application of these

technologies in the actual teaching process is still limited^[6]. On the one hand, physics teachers in many colleges and universities have insufficient understanding and mastery of these new technologies and lack corresponding training and guidance, which makes it difficult to effectively apply them in teaching. On the other hand, the investment in hardware facilities in colleges and universities is also relatively insufficient, such as laboratory equipment, network environment, teaching software, etc., cannot meet the basic needs of the application of new teaching technology. In addition, some colleges and universities have rigid teaching management, and the incentive mechanism for teachers to use new technologies is not perfect, which leads to a lack of motivation for teachers to try and explore new teaching methods. Finally, there are differences in students' acceptance and adaptability to new technology. Some students feel unfamiliar and unadapted to the use of new technology, which affects the improvement of teaching effect^[7].

3. The strategy of college physics course teaching reform under the background of new engineering

3.1. Establish multi-level curriculum system based on diversified professional needs

The rise of new engineering has a more specific and diversified demand for physics knowledge, emphasizing interdisciplinary, technological integration and innovative practice. As a basic discipline, physics plays an increasingly important role in the new engineering major. Under the background of new engineering, the demand for physics knowledge is not limited to the traditional mechanics, electromagnetism, heat and optics, and other basic content, but also emphasizes the application of this knowledge in practical engineering^[8]. For example, emerging fields such as smart materials and devices, new energy technologies, and biomedical engineering all require a deep understanding of the physical properties of materials, energy conversion mechanisms, and biophysical processes^[8]. Research and development in these fields cannot be achieved without a deep understanding and flexible application of physical laws. Therefore, college physics courses need to be adjusted in the teaching content, and increase the applied content closely related to the policy requirements of new engineering, such as physical phenomena in materials science, quantum effects in nanotechnology, optical imaging technology in biomedicine, etc. In addition, it is an effective way to improve the comprehensive quality of students, to strengthen the cross-integration of physics and other disciplines, and to build a multi-level curriculum system. Under the background of new engineering, the teaching of college physics emphasizes the comprehensive application of multidisciplinary knowledge, which needs to be deeply integrated with mathematics, chemistry, computer science, biology, and other disciplines. For example, the course of "Computational Physics" is set up, combining computer programming technology, so that students can master the numerical solving methods of physics problems. In addition, interdisciplinary comprehensive courses such as "Smart Materials and Device Design" can be set up to integrate knowledge from physics, materials science, electronic engineering and other fields to cultivate students' comprehensive innovation ability^[9].

3.2. The teaching content is contemporary and forward-looking, and ADAPTS to the requirements of new engineering

With the rapid development of science and technology, physics, as a basic subject, its research results and technical applications are constantly updated. For example, breakthroughs in quantum computing, nanomaterials, biophysics and other fields have not only provided new perspectives for scientific research, but also brought revolutionary changes to engineering applications^[10]. Therefore, the teaching content of college physics courses

should introduce this cutting-edge knowledge promptly so that students can master the latest physical theories and technologies, and lay a solid foundation for their future development in new engineering fields^[10]. In order to achieve this goal, the teaching content of college physics courses needs to be systematically updated and optimized. First, the course content should cover the latest research results in physics, such as the latest progress in the fields of mechanics, quantum mechanics, relativity, condensed matter physics and so on. For example, quantum computing, as a hot field in recent years, its basic principles, experimental progress, and application prospects should be part of the teaching content. By introducing such cutting-edge knowledge, students' interest in learning can be stimulated and their innovative thinking and spirit of exploration cultivated. At the same time, teachers should encourage students to read the latest scientific research papers and participate in research projects to gain a deeper understanding of the latest developments in physics. In addition, physics teaching content should focus on practicality and application. More experiments and projects should be designed in the teaching content of college physics courses so that students can master physics knowledge and technology in practice. For example, some experimental projects related to industrial production, environmental protection, medical health and other practical issues can be set up, so that students can transform theoretical knowledge into practical skills through hands-on practice^[11].

3.3. Diversified teaching methods should be adopted to activate the teaching atmosphere and rejuvenate the teaching vitality

On the one hand, adopting the case teaching method and the interactive teaching method is an important means to strengthen the interdisciplinary integration of physics teaching content. In case teaching, teachers can choose practical cases that are closely related to new engineering majors. For example, when explaining electromagnetism, the battery management system of electric vehicles can be selected as a case to let students understand the application of electromagnetism in modern industry. Through case analysis, students can not only master physical knowledge but also cultivate the ability to solve practical problems. Interactive teaching principles encourage students to actively participate in class discussions and improve students' teamwork and communication skills through group cooperation and role playing^[12]. For example, when explaining quantum mechanics, students can be organized to discuss the basic principles of quantum computing in groups. Each group is responsible for one aspect and reports at the end. Other groups can raise questions or add opinions to form interactive communication. On the other hand, the use of modern teaching methods is also an effective way to strengthen the interdisciplinary integration of physics teaching content. The development of modern information technology provides abundant resources and tools for teaching, such as virtual laboratories, online course platforms, multimedia courseware, and so on. Among them, the virtual laboratory can allow students to conduct physical experiments in a virtual environment, such as simulating atomic structure, molecular movement, etc., to help students understand physical concepts more intuitively. The online course platform can provide rich learning resources, such as video lectures, interactive exercises, online tests, etc., so that students can learn independently and improve learning efficiency. Multimedia courseware can display complex physical phenomena in the form of animation, images, etc., to enhance the vividness and interest of teaching. For example, when explaining optics, multimedia courseware can be used to show light interference, diffraction, and other phenomena to help students understand abstract concepts^[13].

3.4. Construct a goal-oriented, comprehensive evaluation mechanism for new engineering

The multi-dimensional design of the evaluation content aims to comprehensively evaluate students' knowledge

mastery, practical ability, innovative thinking and teamwork ability. The traditional single examination method can no longer meet this demand, therefore, it is necessary to build a comprehensive evaluation system, covering theoretical knowledge, experimental skills, innovative ability and other aspects. First, the assessment of theoretical knowledge. Through closed-book examinations, open-book examinations, online tests and other forms, these assessments can not only test students' understanding of basic physics concepts and principles, but also assess their ability to apply physical knowledge. For example, closed-book tests can test students' mastery of basic theories, while open-book tests and online tests can assess students' comprehensive ability in accessing materials and solving problems ^[14].

The second is the test of experimental skills. The writing of the experimental report not only requires students to have a solid theoretical foundation, but also requires them to accurately record the experimental data, analyze the experimental results, and write a standard experimental report. The assessment of experimental operation focuses on students' hands-on ability and experimental skills, and examines students' use of experimental instruments and mastery of experimental procedures through practical operation. The assessment of experimental design pays more attention to students' innovation ability and experimental design ability, requiring students to design reasonable experimental schemes according to given problems and carry out experimental verification. The third is the assessment of innovation ability. Through innovative projects, innovative competitions, and innovative papers, the assessment of innovative projects requires students to put forward innovative project plans and carry them out in practice to test their innovative thinking and practical ability. Innovation competition tests students' innovation ability and teamwork ability in a competitive environment by participating in various innovation competitions. The assessment of innovative papers requires students to write high-quality innovative papers that demonstrate their research results and innovative ideas in a certain field. In this way, students' abilities can be evaluated more comprehensively and accurately through the combination of multiple evaluation methods ^[15].

4. Conclusion

In short, this paper first summarizes the concept of new engineering and its requirements for physics teaching in colleges and universities, and points out that the teaching of physics under the background of new engineering needs to be contemporary, forward-looking, and applicable. By analyzing the problems existing in the current physics teaching in colleges and universities, such as the weak curriculum system, the lack of modern teaching content, and the lack of creative teaching methods, it emphasizes the negative impact of these problems on the training of new engineering talents. Given these problems, this paper puts forward some reform strategies, such as establishing a multi-level curriculum system, updating teaching content, adopting diversified teaching methods and constructing a comprehensive evaluation mechanism, to provide strong support for talents training in the background of new engineering.

Disclosure statement

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References

- [1] Zhang Z, 2024, Thinking and Practice of Independent Training of Top-Notch Innovative Talents Under the Background of Strong Education. *China Higher Education*, 2024(7): 15–19.
- [2] Hu Y, Zhu X, Zou H, 2020, Reform and Practice of “College Physics” Teaching Content for “New Engineering.” *Journal of Jiangsu Institute of Technology*, 2020(2): 94–99.
- [3] Liu Y, Wen Y, Jiang F, 2022, Exploration on Modularization Teaching Reform of College Physics Course in Applied Undergraduate Colleges Under the Background of New Engineering. *Heilongjiang Science*, 2022(3): 134–135.
- [4] Wang L, 2022, Reform and Practice of College Physics Curriculum Under the Background of New Engineering. *China Science and Technology Journal Database Research*, 2022(5): 88–91.
- [5] Xu J, Zhang L, Li T, 2020, Thinking on College Physics Teaching Under the Background of New Engineering. *Education Modernization*, 2020(7): 48–49.
- [6] Lin C, Li Q, Yang D, et al., 2020, Exploration and Practice of Physics Practice Course Teaching Under the Background of “New Engineering.” *University Physics Experiment*, 2020(4): 129–132.
- [7] Wu L, Shao C, Shi X, et al., 2022, Reform and Exploration of College Physics Teaching Content Under the Background of New Engineering. *Science and Education Guide*, 2022(31): 115–117.
- [8] Liu S, 2021, Research on College Physics Teaching Reform Under the Background of New Engineering. *Science and Education Guide*, 2021(9): 118–120.
- [9] Liu Z, Li Y, Zhang X, et al., 2022, Exploration and Practice of Wisdom Classroom in University Physics Experiments Based on “Internet+.” *University Physics Experiments*, 2022(3): 150–153.
- [10] Yan J, Li R, Qu K, et al., 2023, Discussion on Teaching Model of Optical and Optoelectronic Experiment Course for Cultivating Innovation Ability. *Journal of Higher Education*, 2023(22): 56–59.
- [11] Li Z, 2024, College Physics Experiment Curriculum Reform Strategy Under the Background of New Engineering. *Journal of Sichuan Vocational and Technical College*, 2024(3): 45–49.
- [12] Wang Z, Nie J, Liu W, et al., 2024, Construction and Innovation Practice of University Science Popularization Base at the Background of “New Engineering.” *Tianjin Science and Technology*, 2024(9): 59–62.
- [13] Li L, Yang W, Xiao M, et al., 2020, Exploration and Practice of New Engineering Talent Training Model Integrating Interdisciplinary and Multi-Major. *Higher Engineering Education Research*, 2020(1): 25–30.
- [14] Li Z, Gao B, Kang C, 2019, Exploration on Practice Teaching Reform of Outstanding Engineering Talents Under the Background of New Engineering. *Higher Engineering Education Research*, 2019(S01): 36–38.
- [15] Chen Q, 2019, The Status and Role of Physics Basic Course Teaching Under the Background of New Engineering. *Chinese University Teaching and Learning*, 2019(5): 34–37.

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Primary School Information Technology Teaching Practice and Thinking Towards Computational Thinking

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Abstract: Under the background of the rapid development of educational informatization, the training of computational thinking has become a crucial goal in primary school information technology teaching. Computational thinking is not limited only to the traditional logical reasoning and problem-solving ability, but also covers a wider range of thinking fields, including abstract thinking, systematic thinking, and innovative thinking^[1]. The training of computational thinking can help students to conduct effective logical reasoning in the face of complex problems, to find the best way to solve problems. At the same time, students are encouraged to jump out of the traditional thinking frame when facing problems and propose novel and unique solutions to effectively cultivate their creativity and innovation ability, to enable students to better adapt to the needs of future social development and improve their comprehensive competitiveness in various fields. In this regard, this paper first clarifies the training principles of students' computational thinking in information technology teaching in primary schools, and then puts forward effective training countermeasures, to provide some references for relevant researchers.

Keywords: Computational thinking; Cultivation; Primary school information technology; Teaching

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1. Introduction

At present, with the proposed and steady advancement of education reform, the reform and innovation of information technology teaching in primary schools is critical. In order to cultivate students' computational thinking more effectively, teachers need to carefully design a series of teaching activities that meet students' cognitive characteristics and learning needs, and ensure that these activities can not only stimulate students' interest in learning, but also help them gradually develop computational thinking abilities such as logical thinking, problem solving and innovative thinking in practical operation. In this way, teachers can carry out information technology teaching based on computational thinking, so that students can deeply understand the connotation of information technology curriculum knowledge in a relaxed and happy learning atmosphere, and

can flexibly use this knowledge, laying a solid foundation for their follow-up study and life, and promoting their sustainable development.

2. The training principles of students' computational thinking in primary school information technology teaching

2.1. The principle of practicality

In the teaching of information technology in primary schools, problem-solving ability is an important indicator to measure computational thinking. Therefore, teachers should be good at creating problem situations or arranging a lot of practical activities in combination with the teaching content, so that students can continuously improve their problem-solving ability in the actual operation ^[2]. If students can flexibly apply what they have learned in the process of problem solving, they can not only internalize the theoretical knowledge they have learned, but also accumulate richer practical experience. They can better apply what they have learned to solve practical problems in future study and life, and promote their computational thinking to be further improved.

2.2. Guiding principle

Primary school students are still young, have relatively less social experience, and their way of thinking has certain limitations. In order to improve the training effect of computational thinking, teachers should always adhere to the guiding principle in the teaching of information technology ^[3]. For example, when students encounter difficulties or need help, teachers should play a good role as guides, think with students, and find ways to solve problems. In this way, students' thinking mode can be perfected, and their computational thinking ability can be continuously strengthened.

2.3. Principle of subjectivity

In the training of computational thinking, teachers should emphasize students' subjectivity and implement the teaching idea of "student-oriented," which requires teachers to adhere to the principle of subjectivity in information technology teaching. Specifically, teachers should deeply understand and master the actual needs of students in each learning stage, and gradually establish the concept of student-oriented education. At the same time, teachers also need to pay full attention to the development of students, and actively understand the characteristics of students' computational thinking, work out more appropriate information technology teaching programs, and ensure that all teaching activities are carried out around the actual needs of students ^[4].

3. Training countermeasures of computational thinking in primary school information technology teaching

3.1. Close contact with real life arouses students' interest in learning

In real life, information technology is everywhere. Teachers take the initiative to contact real life to carry out information technology teaching, and give play to their guiding role in classroom teaching, which can help students have a deeper understanding of information technology knowledge and effectively promote the development of students. Therefore, in the actual teaching process, teachers can show students the specific application of information technology in real life, so as to make them have a strong interest in information technology learning, and can also have a cognition and understanding of the specific scenes of information

technology^[5]. For example, when teaching “Experience Human-Computer Interaction,” teachers can closely connect with real life, create a virtual shopping interaction system combined with teaching content and objectives, and simulate the most realistic shopping situation. Students can play various roles in the virtual shopping interaction system, and can carry out a shopping experience in the virtual space, and experience various human-computer interaction scenes. At the same time, when students encounter technical failures in the virtual shopping interactive system, they will actively use the knowledge they have mastered to think about how to solve these failures or seek help from teachers and professionals. In addition, teachers can also guide students to think about how to improve and optimize the virtual shopping interactive system, such as what functions can be added to make the shopping experience more convenient and how to improve the user friendliness of the interface. In addition, the close combination of real life and information technology knowledge can not only effectively activate students’ desire to explore, but also make them more intuitive to feel the principle of human-computer interaction, but also deepen the understanding and mastery of the teaching content of this section through personal practice, and develop students’ computational thinking ability in the process of problem solving^[6].

3.2. Introduce project-based learning to enhance problem-solving ability

Information science and technology courses not only have strong practicality, but also the speed of knowledge update is relatively fast. In this regard, teachers should make full use of the teaching form of project-based learning, so as to fully develop students’ potential and improve their problem-solving ability, which is also an effective means to improve students’ computational thinking. At the same time, teachers can also rely on project tasks to divide teaching activities into several links, guide students to think deeply about information technology knowledge, and complete project tasks in small groups, improve their problem-solving ability, and lay a solid foundation for improving the quality of computational thinking training^[7]. For example, when teaching “Beautifying Pictures,” teachers can design the following project tasks: take relevant photos for campus activities, and use image processing software to beautify these photos, such as adding special effects, cutting composition, and adjusting colors. In the process of completing the project tasks, students can not only master image processing skills but also understand the importance of image beautification processing in different scenes. For example, when students provide pictures for school news reports, they will ensure that the colors are natural and the pictures are clear, and they can accurately convey relevant information with the help of pictures. In addition, in project-based learning, teachers break through the role of knowledge transmitter, give full play to their guiding role, and actively encourage students to explore independently, ask questions, and find solutions together in group cooperation. In this way, students can learn how to analyze problems, design project solutions, and effectively complete project tasks with the information technology knowledge they have mastered. In this process, they can naturally improve their information technology literacy and computational thinking ability, and effectively enhance students’ teamwork spirit and innovation ability^[8].

3.3. Focus on strengthening practical teaching and training students’ thinking ability

In the teaching of information technology, the generation and development of computational thinking are based on practice, and it is far from enough to rely solely on theoretical teaching. Teachers need to gradually strengthen practical teaching, so that students can accumulate rich practical experience from IT, and improve students’ understanding of information technology knowledge through the process of “finding problems - abstract generalization - modeling operations - solving problems.” Continue to strengthen their practical operation ability and problem-solving ability, and then form superior computational thinking. In the process of strengthening

practical teaching, teachers should give priority to students' independent practice, and provide necessary guidance and inspiration by themselves. They can also sort out problems in independent practice into teaching resources to gradually improve students' thinking ability ^[9]. At the same time, teachers should also actively organize students to think about whether the problem is reasonably solved, whether the method of solving the problem can be further optimized, and explore whether other methods can be used to solve the problem to promote the in-depth development of students' computational thinking. For example, when teaching "Making Digital Tabloids," teachers can first let students understand the basic concept and production process of digital tabloids, and then let them design and make them themselves. In this process, students need to apply their theoretical knowledge and operational skills, such as text editing and picture processing, and think about how to organize information in a way that is both beautiful and practical. In the process of independent practice, teachers can observe what links students encounter difficulties in and give timely guidance. For example, if students encounter problems in typographic design, teachers can guide students to think about how to improve visual effects by adjusting font size, color contrast, layout, etc. Through such practical activities, students can not only exercise their computational thinking, but also improve their ability to solve practical problems, thus effectively enhancing their comprehensive literacy ^[10].

3.4. Enrich classroom teaching resources to meet students' inquiry needs

In the teaching of information technology in primary schools, in order to fully satisfy students' inquiry needs, teachers should not only make full use of existing teaching resources, but also actively develop and use excellent resources outside the classroom, so as to avoid teaching falling into the dilemma of lack of resources and effectively broaden students' professional vision. In the process of developing and applying teaching resources, teachers should ensure that the selected resources are consistent with students' age characteristics and teaching content, effectively expand students' way of thinking, improve students' computational thinking in multiple dimensions, and ensure that they can achieve better learning results and achieve the expected learning goals ^[11]. For example, when teaching "Cognitive Digital Works", teachers can introduce multimedia teaching software so that students can learn the creative process of digital works interactively. Through the software, students can not only visually see the production steps of digital works, but also operate them themselves and experience the creation process from scratch. Such teaching resources can not only stimulate students' interest in learning but also help them understand abstract computing concepts such as algorithms and programming logic. In addition, teachers can make use of online platforms, such as the Programming Education website, to provide students with additional learning materials and programming challenges, encourage students to continue exploring and practicing outside of class time, encourage them to continue to develop their computational thinking outside of the classroom, and at the same time, teachers can understand their learning progress and difficulties through online platforms. In order to provide them with targeted instruction. In this way, by constantly enriching and optimizing information technology teaching resources, teachers can provide students with a comprehensive, interactive, and challenging learning environment and promote their comprehensive development of computational thinking ^[12].

3.5. Pay attention to the summary and reflection, and promote the training of computational thinking

In the direction of computational thinking, after the teaching of information technology, teachers should pay enough attention to the sharing and communication of students, leave enough time for students to display

and share their works, actively encourage other students to comment, and ensure that they clearly identify the shortcomings and references of their works in the process of mutual comment and work sharing. Make clear the distance between themselves and other students, make continuous efforts in the direction of their improvement, constantly improve their computational thinking, promote the improvement of information technology learning ability and application ability in self-reflection and summary, form a good habit of independent reflection, and then escort students to achieve personalized development^[13]. For example, when teaching “Sharing Learning Resources,” students can share how they collect and screen information resources, as well as the problems and solutions encountered in the process of resource sorting and classification. Such sharing not only helps students realize the importance of information resources but also stimulates them to think deeply about information technology. In addition, teachers can also guide students to self-reflection and encourage them to think about which methods are effective and which need improvement in the learning process. Through regular self-reflection, students can better understand their learning habits and thinking patterns, and thus improve their learning purpose and efficiency. In addition, based on students’ self-evaluation and mutual evaluation, teachers should conduct a comprehensive evaluation on students based on their performance in class and works, and give targeted suggestions, to better promote the full penetration of computational thinking training in information technology teaching and further promote the rapid improvement of students’ computational thinking ability, learning and application ability. To promote the comprehensive development of students’ abilities^[14].

4. Conclusion

All in all, under the current educational background, cultivating students’ computational thinking has become an important orientation of information technology teaching in primary schools^[15]. Therefore, teachers should constantly study the teaching methods, innovate and optimize the current teaching methods, such as the implementation of close contact with real life, mobilize students’ interest in learning; Introduce project-based learning to enhance problem solving ability; Focus on strengthening practical teaching to exercise students’ thinking ability; Enrich classroom teaching resources to meet students’ inquiry needs; Pay attention to summary and reflection, promote the training of computational thinking and other countermeasures, so as to effectively develop students’ computational thinking, continuously consolidate their comprehensive literacy, and continuously improve the effectiveness of information technology teaching.

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References

- [1] Wang R, 2024, Research on the Cultivation of Computational Thinking in Primary School Students’ Information Technology Teaching Based on Deep Learning. *Mingshi Online*, 9(31): 44–46.
- [2] Zhang J, 2024, Research on Scaffolding Teaching of Information Technology in Primary Schools from the Perspective of Computational Thinking – Taking “Circular Structure” as an Example. *New Curriculum Guidance*, (27): 49–52.
- [3] Zhang W, 2019, Design and Practice of Information Technology Gamification Teaching Activities in Primary

- Schools Under the Training of Computational Thinking. *Educational Observation*, 13(26): 92–94.
- [4] Tao X, 2024, Primary School Information Technology Classroom Teaching Towards the Training of Computational Thinking. *Primary School Students (Middle Ten-Day Issue)*, 2024(8): 64–66.
 - [5] Chen Y, 2024, Teaching Path of Information Technology in Primary School Based on Training of Computational Thinking – A Case Study of Graphic Programming for the First Time. *Information Technology Education in Primary and Secondary Schools*, 2024(6): 59–60.
 - [6] Hui B, 2024, Research on Visual Teaching Practice of Information Technology Thinking in Primary School Oriented Towards Computational Thinking. *Electronic Education in Primary and Secondary Schools*, 2024(5): 88–90.
 - [7] Chen S, 2024, Research on Project-Based Teaching Practice of Information Technology in Primary Schools Based on Computational Thinking. *Mingshi Online*, 2024(4): 8–10.
 - [8] Shi K, 2024, Problem-Solving Teaching Strategies of Information Technology in Primary Schools Oriented Towards Computational Thinking – A Case Study of “Intelligent Classroom Lighting System” Project. *China Information Technology Education*, 2024(2): 63–65.
 - [9] Wang Z, 2023, Practical Research on the Training of Computational Thinking in Primary School Information Technology Programming Teaching. *Proceedings of “Integration of Education and Innovation” Seminar of Guangdong Continuing Education Society (V), Central Primary School of Yanghu Township, Yangxin County, Binzhou City, Shandong Province, China.*
 - [10] Gu Z, 2023, “Spiral” Learning: Construction and Direction of Computational Thinking Training Paradigm – A Case Study of Primary School Information Technology Teaching. *Research on Education and Equipment*, 39(6): 45–48.
 - [11] Guo J, 2023, Construction and Application of Information Technology Experiential Teaching Model for Primary School Oriented to Computational Thinking Literacy, thesis, Hebei University.
 - [12] Zhang Y, 2023, Research on the Design of Information Technology Gamification Teaching Activities in Primary Schools from the Perspective of Computational Thinking, thesis, Hebei Normal University of Science and Technology.
 - [13] Ma F, 2022, Training of Computational Thinking in Primary School Information Technology Teaching – A Case Study of Graphical Programming Lesson “Guess the Numbers.” *China Information Technology Education*, 2022(22): 51–53.
 - [14] Qian X, 2022, Activity Board Book: A New Pattern of Primary School Information Technology Teaching Oriented to Computational Thinking. *China Information Technology Education*, 2022(19): 68–70.
 - [15] Luo C, 2022, Computational Thinking Generation in Information Technology Teaching in Primary School. *Journal of Curiosity*, 2022(24): 53–55.

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The Application of AI Technology in College Accounting Teaching

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Abstract: In the era of “Internet +”, artificial intelligence, big data and virtual simulation technology are applied more and more deeply in the teaching of accounting majors in colleges and universities. They not only expand the teaching space of accounting majors and enrich teaching resources, but also accurately push personalized learning resources, online testing and other services for students, which is conducive to improving the teaching quality of accounting majors in colleges and universities. This paper analyzes the importance of AI technology to accounting teaching in colleges and universities, analyzes the logic of AI technology to boost accounting teaching reform, and puts forward the construction of intelligent financial sharing practical training teaching platform, the development of online and offline mixed teaching, the use of AI technology to carry out auxiliary teaching and improve the teaching evaluation system. The course teaching practice effect of evaluation and data analysis, the conclusion is that through the application of AI technology in accounting teaching, it effectively improves the students’ understanding of accounting theory and practice, to achieve the effect of training talents more efficiently.

Keywords: AI technology; College accounting major; Importance; Application path

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1. Introduction

Since the Ministry of Finance issued the “Accounting Informatization Development Plan (2021–2025)” and the “Outline of the 14th Five-Year Plan for Accounting Reform and Development” at the end of 2021, the requirements for accounting teaching in colleges and universities have been continuously improved, especially to promote digital transformation and improve the comprehensive ability of enterprise financial personnel. Colleges and universities should actively integrate AI technology, build intelligent practical training platforms, carry out mixed online and offline teaching, promote the connection between in-class and out-of-class teaching, provide personalized learning resources, stimulate students to study independently, and improve their financial management and accounting skills. By investigating the practice and feedback of AI technology application in the School of Economics and Management of China University of Geosciences (Beijing), combined with data analysis, this paper aims to provide empirical support for the positive impact of AI technology in accounting

teaching and provide a reference for future teaching design.

2. The importance of AI technology to accounting teaching in colleges and universities

2.1. It is conducive to the development of personalized teaching

AI technology analyzes students' learning progress and ability through big data in accounting teaching in colleges and universities, supports personalized teaching, meets students' individual needs, and improves their independent learning ability ^[1]. Teachers can adjust teaching strategies according to students' learning data, customize learning resources and tasks, and help students master professional knowledge through online interaction and timely answer questions, thus improving teaching quality. The AI-driven teaching model focuses on personalized development of students and provides customized teaching support through intelligent analysis of data.

2.2. It is conducive to optimizing the allocation of teaching resources

The application of AI technology in accounting teaching in colleges and universities is helpful in optimizing the allocation of teaching resources. Through the virtual simulation technology, students can master the skills of accounting, practical operation and management accounting in the simulated enterprise financial management scenario, to improve their practical ability ^[2]. AI also makes the allocation of teaching resources more intelligent, and teachers can dynamically adjust the ratio of theoretical and practical courses according to students' learning progress and needs to ensure the optimal allocation of resources. AI supports blended teaching and uses big data to analyze student achievement and satisfaction to help teachers identify problems in teaching promptly and improve teaching effectiveness and quality ^[3].

2.3. It is conducive to improving the quality of training accounting professionals

With the development of the digital economy, the extensive application of ERP financial robots, financial sharing platforms and big data technologies in enterprise financial management has increased the requirements of financial managers for digital tools, which in turn has changed the demand for accounting talents ^[4]. AI technology helps to improve the training program for accounting professionals, integrates new technologies such as financial sharing, big data and cloud computing into teaching, improves students' application ability of digital tools and financial management ability, to improve the training quality of accounting talents ^[5].

3. The application path of AI technology in accounting teaching in colleges and universities

3.1. Build a financial sharing training platform to improve the quality of practical training

Colleges and universities should actively introduce enterprise financial sharing system, build intelligent accounting practical training platform, optimize teaching environment through AI technology, simulate the scenario of industry and finance integration, innovate teaching content and methods, and improve students' vocational skills in intelligent finance and taxation, management accounting and accounting practice ^[6].

3.1.1. Construction of financial sharing training platform

Schools can build a training platform that simulates the integrated management process of industry and finance,

covering modules such as general ledger, receivables and payables, fixed assets and cost management. By allowing students to enter accounting vouchers, query account books and generate statements, the school can deepen their understanding of the connection between financial management and business marketing data, and help students master job skills ^[7].

3.1.2. Online practical training tasks and intelligent assessment

Teachers can design different online practical training tasks and require students to complete them within a specified time, and guide them through intelligent assessment and video review. By analyzing student operation videos, teachers can find problems in time and guide students to carry out targeted exercises, improve financial management and data analysis skills, and thus improve teaching quality ^[8].

3.2. Carry out blended teaching and build a wisdom classroom for accounting profession

In the era of artificial intelligence, accounting teachers in colleges and universities should actively adopt a mixed teaching mode to improve teaching quality.

3.2.1. Use the Hyperstar Learning APP to carry out blended teaching

Teachers should make clear the connection point between online and offline teaching, and help students master the teaching content through online micro-lessons and preview tasks ^[9]. For example, in the course of “Management Accounting”, teachers can import data from various departments of enterprises, guide students to analyze financial data, and make operational and management forecasts based on this data to improve data analysis ability.

3.2.2. Intelligent online testing and marking

Teachers can design multiple choice questions, fill-in-the-blank questions, calculation questions and other online tests, and use artificial intelligence technology to conduct intelligent marking, which not only tests the teaching effect, but also evaluates students’ knowledge grasp, and provides data support for offline teaching ^[10].

3.2.3. Targeted explanation of offline teaching

Teachers can focus on the wrong questions and common problems in students’ online tests to help students improve their knowledge system, answer questions and solve doubts, further promote the effective connection between online and offline teaching, and improve the quality of blended teaching.

3.3. AI technology assists classroom teaching and improves the quality of classroom teaching

The application of AI technology in the teaching of accounting majors in colleges and universities can improve the quality of classroom teaching, help teachers realize personalized teaching, identify the shortcomings of students’ majors, and improve students’ learning results.

3.3.1. Data analysis and personalized teaching

Teachers can intelligently analyze students’ learning effect, homework quality and online learning enthusiasm by exporting the data of the Super Star Learning platform and using big data and cloud computing technology. According to the analysis results, teachers can recommend personalized learning resources and exercises for

students, help students to check the gaps, and improve the learning efficiency and quality of professional courses ^[11].

3.3.2. AI-assisted accounting qualification certificate training

Teachers can use AI technology to carry out an online simulation test of the accounting professional technical qualification certificate, introduce exam questions from the past three years, clarify the assessment focus, and help students get familiar with the exam content. Students can choose practice modules to test personal operational ability, identify knowledge shortcomings, and conduct targeted review to successfully pass the exam and enhance employment competitiveness ^[12].

3.4. AI technology empowers teaching evaluation to improve the quality of teaching evaluation

The application of AI technology in teaching evaluation brings accurate and objective feedback to the teaching of accounting majors in colleges and universities, and promotes the improvement of teaching quality ^[14].

3.4.1. Process evaluation and teaching adjustment

Teachers can use AI technology to conduct real-time evaluation of the online teaching process and intelligent practical training operation, analyze students' learning engagement, homework quality and test scores and other data, timely find problems and adjust teaching content and methods, so as to improve teaching quality ^[14].

3.4.2. Student questionnaire survey and self-assessment and mutual assessment

Teachers can conduct anonymous questionnaire survey through AI, so that students can evaluate teachers' teaching ability, digital resources and intelligent practical training effects, stimulate the enthusiasm of independent learning, and promote mutual assistance and reflection among students through online self-assessment and mutual assessment, optimize the learning atmosphere and improve the teaching level of accounting ^[13].

4. Evaluation and analysis of applied teaching effect

4.1. Questionnaire survey and data analysis

After adding AI teaching mode to the traditional accounting teaching, accounting students' interest in learning has increased greatly. In November 2024, 119 accounting undergraduate questionnaires were issued on the Juanxing platform, and 101 valid questionnaires were recovered. The specific evaluation is as follows.

4.1.1. Experience analysis of the financial sharing practical training platform

According to the results of the questionnaire, 96.58% of the students believed that the AI-combined financial sharing training platform helped them better understand financial management and accounting practices. More than 92% of the students believe that AI answering questions is helpful to accounting practice in the operation exercises, such as accounting voucher entry, book inquiry and statement generation. 91.03% of the students were able to complete and understand the practical training tasks in the integrated management mode of industry and finance through the platform, and the AI accurately identified and gave feedback on specific operational errors.

4.1.2. Blended teaching mode

According to the results of the questionnaire, 93.24% of the students believe that AI micro-lessons and dynamic

videos help them master the classroom content in advance. 91.2% of the students believed that in the accounting course, they significantly improved their data analysis ability through the data analysis and prediction tasks of AI technology statistics, indicating that AI has played a role in improving students' practical operation ability in teaching. 91% of the students believed that AI online test system was effective in checking knowledge points, indicating that AI online test system played a positive role in students' learning evaluation. 95% of the students believe that making full use of AI to search specific topics in offline teaching can help students understand and master knowledge points, reflecting that the rational use of AI technology can improve learning results.

4.1.3. Overall comprehensive evaluation

92% of the students believe that the application of AI technology in accounting teaching has significantly improved the learning efficiency, indicating that AI has improved the learning effect of students in accounting teaching. 63% of the students believe that the biggest advantage of AI in accounting teaching is to enhance practical ability, which indicates that most students attach more importance to the role of AI in improving practical ability. 12% of students believe that the advantage lies in personalized learning, indicating that AI personalized learning is the future.

4.2. Conclusions and suggestions

Through the introduction of AI technology, students' learning experience and teaching effect have been significantly improved, especially in the application of a financial sharing practical training platform and blended teaching mode, students' practical ability and data analysis ability have been enhanced ^[14]. However, there is still some room for improvement, especially in the feedback mechanism of the platform, the intellectualization of the test system, and the optimization of the teaching evaluation system. By further strengthening the application of AI technology, improving teachers' ability to analyze data, and focusing on practical ability and the depth of personalized learning, it will help further improve the quality of accounting teaching and students' learning outcomes ^[15].

4.2.1. Further optimize the intelligent feedback of the platform

Although 91% of the students believe that the platform can accurately identify and give feedback on operational errors, there are still 9% of the students' feedback may be insufficient, suggesting that the intelligent feedback mechanism of the platform should be further optimized to provide more detailed and targeted error tips and improvement suggestions. AI technology can be combined with deep learning to automatically identify students' common error patterns and push targeted learning resources to help students make up for their knowledge blind spots.

4.2.2. Strengthen the intelligence of AI online tests

At present, the AI online test system can effectively check students' mastery of knowledge points, but it can further use big data and AI algorithms to analyze students' answer trends and provide more intelligent learning feedback. For example, according to students' error frequency and understanding deviation, push targeted review resources to help students make up for their shortcomings. A dynamic test system adapted to different learning levels will be developed to automatically adjust the difficulty of questions according to students' answers, to improve the personalization and accuracy of the test.

4.2.3. Enhance the depth and effect of personalized learning

While 12% of students identified personalized learning as one of the strengths of AI technology, there is still room for further improvement. More precise personalized learning resources can be pushed through a more detailed learning path planning system that combines students' learning progress and interests to help students better master knowledge at their own pace.

5. Conclusion

In short, it is an inevitable trend for AI technology to enable accounting teaching in colleges and universities, which is conducive to expanding the teaching content of professional courses, meeting the personalized learning needs of students, broadening the teaching channels, building the smart classroom model, and thus improving the teaching quality of accounting. However, there is still room for optimization in the application of AI technology in teaching, especially in the intelligent feedback mechanism, the personalized adjustment of the online test system and the personalized learning path design. In the future, colleges and universities should further deepen the application of AI technology, improve teachers' ability in data analysis, and promote a more intelligent and personalized teaching environment. Accounting teachers in colleges and universities should make good use of the financial sharing practical training platform, improve the quality of practical training, and deepen students' understanding of the integration mode of industry and finance. To carry out blended teaching and build a smart classroom for accounting majors. AI technology-assisted classroom teaching to improve the quality of classroom teaching; AI technology enables teaching evaluation, improves the quality of teaching evaluation, and comprehensively improves the teaching quality of accounting majors.

Disclosure statement

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References

- [1] Tu S, 2024, Application of Information Technology in Accounting Teaching in Higher Vocational Colleges in the Era of Artificial Intelligence. *Journal of Nantong Vocational University*, 38(1): 48–52.
- [2] Yang H, 2024, Research on Virtual Teaching Reform of Accounting Major in Higher Vocational Colleges Under the Background of Artificial Intelligence. *Shaanxi Education (Higher Education)*, 2024(2): 63–65.
- [3] Zhang M, 2024, Research on Reform and Optimization of Vocational Accounting Practice Teaching Under the Background of Artificial Intelligence. *Shaanxi Education (Higher Education)*, 2024(2): 72–74.
- [4] Zhang S, Mao Z, Yuan Z, et al., 2023, Research on Teaching Reform of Finance and Accounting Major in Higher Vocational Colleges Under the Background of Artificial Intelligence. *Internet Weekly*, 2023(24): 77–81.
- [5] Wang B, 2023, Application of Artificial Intelligence Technology in Teaching of Big Data and Accounting Major. *Science and Technology Economic Market*, 2023(12): 134–136.
- [6] Shu Y, 2023, Research on Teaching Reform of Accounting Major in Secondary Vocational Schools Under the Background of Artificial Intelligence Development. *Teachers*, 2023(29): 117–119.
- [7] Xiang F, Chen X, 2023, Research on New Business Teaching Reform in Higher Vocational Colleges Under the Background of Artificial Intelligence—Taking Big Data Accounting Major as an Example. *China Management*

Information Technology, 26(10): 197–200.

- [8] Li F, 2023, Research on the Innovation of Accounting Teaching System Under the Background of Artificial Intelligence. *Anhui Education and Research*, 2023(12): 110–112.
- [9] Zhang X, 2022, Reform and Innovation of Practice Teaching of Management Accounting Under the Background of Artificial Intelligence. *Journal of Tianjin Vocational Colleges*, 24(10): 87–90 + 96.
- [10] Shi Y, Wang F, Hou L, 2022, Analysis on Teaching Reform of Management Accounting in Colleges and Universities Under the Background of Artificial Intelligence. *Accounting of Township Enterprises in China*, 2022(10): 196–198.
- [11] Ding G, Chen D, Peng S, 2022, Construction of Modern Intelligent Classroom Teaching Model of Higher Vocational Accounting Education Based on Artificial Intelligence. *Quality and Market*, 2022(14): 139–141.
- [12] Bai Q, 2022, Research on Teaching Reform of Basic Accounting Course Under the Background of Artificial Intelligence. *Certified Public Accountants*, 2022(4): 99–100.
- [13] Lai J, 2021, Discussion on the Reform of Accounting Major in Higher Vocational Colleges From the Perspective of Artificial Intelligence. *China Management Informatization*, 24(22): 230–231.
- [14] Zhou Y, 2021, Research on Reform of Teaching Standards of Accounting Major in Local Applied Colleges and Universities in the Era of Artificial Intelligence. *Public Standardization*, 2021(21): 95–97.
- [15] Ding L, 2021, The Change of Accounting Teaching Model in the Era of “Artificial Intelligence +”. *Science and Education Guide*, 2021(9): 60–63.

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Study on Chinese Curriculum Reform in Applied Colleges and Universities from the Perspective of Vocational Core Literacy Education

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Abstract: Chinese courses in applied colleges and universities, different from the Chinese courses in higher vocational education and general undergraduate education, highlight the word “application” in teaching activities, dialectically and inclusively look at the relationship between “application” and “academic,” which can provide targeted support for the training of applied talents in higher technology. In the perspective of vocational core quality education, the reform of applied college Chinese curriculum should be carried out to further strengthen the connection between talent training and industry development needs, which is in line with the talent training orientation of applied colleges and universities and the talent needs of industry transformation and upgrading. Therefore, this paper first analyzes the specific content of the vocational core literacy of students in applied colleges and universities, and then proposes feasible course reform strategies based on the author’s practical experience.

Keywords: Vocational core literacy education; Applied colleges and universities; Chinese course; Reform

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1. Introduction

Application-oriented undergraduate colleges focus on the management, service, production and construction of advanced technology application-oriented talents training, which is significantly different from higher vocational colleges and ordinary undergraduate colleges in the orientation of talent training, requiring Chinese courses not only to serve the students’ learning of basic theoretical knowledge, but also to consider the needs of students to use the theoretical knowledge to innovate and practice. Teachers should proceed from the perspective of vocational core quality education, combine the historical and humanistic advantages of college Chinese courses, and constantly promote the reform of Chinese courses, enhance their applicability and practicability, so as to provide students with the required learning field for application-oriented talents.

2. The specific content of the vocational core quality of students in applied colleges and universities

2.1. Learning quality

With the awareness and ability of lifelong learning, students can keep pace with the era in their thinking, cognition and ability in their future career development, and avoid being “left behind” because they cannot keep up with the pace of development of the era. Therefore, learning literacy is an important part of the core vocational literacy of students in application-oriented colleges and universities ^[1]. When cultivating students’ learning quality in the Chinese courses of application-oriented colleges and universities, it is necessary to strengthen students’ awareness of innovation, enhance students’ attention to current affairs, and guide students to learn learning as the key, and guide them to explore the new model and new path of industry development by virtue of language knowledge, learning spirit, assiduously studying, cooperation and communication, so as to enter the workplace in the future. To lay a solid foundation for the realization of personal career development goals. At the same time, in order to shape the students’ consciousness of “never too old to learn,” teachers also need to improve the students’ personality quality and cultivate the students’ sense of social responsibility in the teaching of Chinese courses, so as to make them deeply realize the importance of learning to adapt to social development, maintain a positive attitude of being willing to learn and taking the initiative to learn, and explore a wide range of learning methods suitable for themselves ^[2].

2.2. Professional quality

Generally speaking, professional quality includes several key elements such as life safety awareness and self-identification awareness, which are the contents that students need to focus on and learn in the Chinese course learning of application-oriented colleges and universities. At the beginning of entering applied colleges and universities, students need to learn professional knowledge and vocational skills based on the existing theoretical knowledge system, improve personality quality, strengthen self-identification awareness, and actively participate in daily learning activities. In this process, on the one hand, students need to master all aspects of knowledge and skills required for professional development; on the other hand, they need to strengthen their satisfaction, career achievement, and enhance their legal awareness ^[3].

2.3. Career accomplishment

In the core vocational quality, career quality is an indispensable part, which mainly includes the ability of career adaptation, career development and planning, which is an important guarantee for students to adapt to industry development and achieve career development goals, and is also the focus of students’ learning process. In the learning stage of Chinese courses in application-oriented colleges and universities, students need to complete the transition from theoretical learning to the real society, and should make clear the internal connection between the quality of academic completion and career development, and make better preparation for career development by completing the learning task of Chinese courses ^[4]. Under normal circumstances, application-oriented colleges and universities will set up special career planning courses to guide students to analyze professional characteristics and their own career development needs, and make career plans based on them. However, it is far from enough to simply rely on this course to cultivate students’ career accomplishments and guide students to explore the path of career development. Teachers should attach importance to interdisciplinary teaching in the process of teaching Chinese courses in application-oriented colleges and universities, integrate the content of career planning courses and Chinese courses, and further strengthen students’ awareness of career planning.

This can encourage students to make scientific presets for the career development goals to be implemented at each stage, at the same time, under the guidance of career development goals, rationally plan course learning and career development paths, and purposefully exercise their social practice ability, professional ability and other abilities in the process of learning ^[5].

2.4. Information literacy

With the advent of the Internet era, information literacy has become a necessary quality for application-oriented college graduates, which mainly includes machine management, resource planning, and other abilities, and is the key for students to adapt to social life and industry development. In view of the current transformation and upgrading needs in various fields, application-oriented colleges and universities need to focus on cultivating application-oriented talents of advanced technology, so that students can master the qualities and skills needed to engage in related occupations, and help them gain a firm foothold in the future career development road. Therefore, information literacy should be included in the core vocational literacy of students in application-oriented colleges and universities. Teachers should consciously guide students to master intelligent and information means in combination with their major, and cultivate their ability to collect, process and apply information ^[6].

3. The teaching strategies of Chinese courses in application-oriented colleges and universities from the perspective of vocational core literacy education

3.1. Restructure college Chinese teaching objectives and highlight “application”

The teaching of Chinese courses in application-oriented colleges and universities needs to serve the training of application-oriented talents, and should pay attention to the important issue of students’ future employment. In order to cultivate students’ vocational core quality and promote students’ high-quality employment, teachers need to reconstruct college Chinese teaching objectives, integrate and highlight the word “application” in it, that is, to enhance students’ language ability and enhance students’ employment competition as the direction, further highlight the “combination of employment positions and humanistic quality, theoretical courses and students’ employment”. Explore a Chinese teaching model that takes into account students’ technical knowledge and basic knowledge learning needs, and promotes students’ humanistic quality and employment practice ability to be enhanced in both directions ^[7]. Specifically, from the perspective of vocational core literacy education, the teaching objectives of Chinese courses in application-oriented colleges and universities should include the following contents:

- (1) Knowledge teaching objectives, which mainly involve four aspects: historical knowledge, cultural knowledge, language and text, and classic reading. This means that college Chinese courses need to combine their own content characteristics and the talent training orientation of application-oriented colleges and universities, gradually implement knowledge education goals, and integrate the above four aspects relying on the process of teaching China’s 5,000 years of civilization, so as to highlight the humanistic characteristics of Chinese courses and speed up the cultivation of students’ humanistic qualities ^[8].
- (2) It is the goal of ability training. College Chinese courses under the vision of vocational core literacy education need to focus on the development of students’ overall ability, such as innovation ability, knowledge transfer ability, literary reading and appreciation ability, language application ability and so on.
- (3) The goal of integrating moral education into the curriculum. As an important carrier of moral education

in application-oriented colleges and universities, college Chinese curriculum needs to pay attention to the development of students' moral qualities, effectively spread humanistic spirit through various measures, exert the educational value of the curriculum, and promote the implementation of the fundamental task of cultivating morality and cultivating people.

Based on the above points, the Chinese course teaching in application-oriented colleges and universities from the perspective of vocational core quality education needs to achieve three goals, namely knowledge teaching, ability training and moral education, so as to provide various support for students to grow into application-oriented talents needed in the new era ^[9].

3.2. Taking into account basic learning and skill-based learning to improve the quality of personnel training

Different from other types of talent training, application-oriented talent training further emphasizes the applied attributes of teaching mode, requires teachers to unify students' basic learning and skill-based learning, organically integrate them into college Chinese teaching curriculum, and dynamically adjust the specific implementation process, so as to identify the "main axis" and "support" and complete the construction of teaching system. According to the needs of application-oriented talents training, teachers should construct a comprehensive teaching system with "basic knowledge as the main axis and skill knowledge as the support" from the perspective of vocational core quality education to create conditions for the all-round development of students' application ability ^[10]. This requires teachers to first highlight the employment-oriented teaching in college Chinese teaching and make dynamic adjustments to the actual teaching content ^[11]. In the construction of teaching content, college Chinese courses should not only pay attention to the enhancement of students' humanistic quality, but also pay attention to the cultivation of students' employment competitiveness, and take the path of employment-oriented teaching. Specifically, college Chinese courses should emphasize the application of knowledge, strengthen the teaching of language expression, appreciation of works and writing, and help students master various language abilities needed to adapt to the future career development environment.

Secondly, teachers should attach importance to the interdisciplinary teaching of college Chinese courses and professional courses to cultivate students' comprehensive application ability of knowledge of various disciplines, that is, based on the core vocational quality education, integrate the content of college Chinese courses and professional courses, and create a new "support point" of college Chinese courses for majors. Students of different majors and at different learning stages tend to have different demands for applied knowledge learning, so teachers should keep the dynamic adjustment of teaching content in interdisciplinary teaching. Finally, teachers need to optimize the various teaching modules of college Chinese courses according to the requirements of actual industry development. From the perspective of vocational core literacy education, college Chinese courses should aim at cultivating application-oriented talents with "knowledge + skill + high quality," adjust the ratio between theoretical knowledge teaching hours and practical teaching hours, and promote the "combination of science and practice" of college Chinese courses, and students' learning is linked ^[12].

3.3. Facing students' employment, innovative teaching implementation methods

The implementation of teaching objectives and plans requires teachers to carry out work practice based on appropriate teaching methods. Therefore, the reform of college Chinese curriculum from the perspective of vocational core literacy education should pay attention to the innovation of teaching implementation methods. Specifically, under the guidance of the "student-centered" teaching concept, teachers can highlight the "four

combinations” in college Chinese teaching, and then design learning tasks that meet the needs of students’ knowledge and skill application ability cultivation, to encourage them to explore independently under task-driven^[13]. This is a teaching method of “teaching, learning and doing together”, which can strengthen the combination of inside and outside school, in class and after class, learning and practice, teaching and learning, and improve the practicality of college Chinese teaching. Among them, the combination of in-school and off-campus requires students to break through the shackles of textbooks and go to society in the process of college Chinese learning, combining practice and experience to learn, understand and apply Chinese knowledge^[14]. The combination of in-class and after-class requires teachers to integrate online teaching and offline teaching through various information technology means, guide students to carry out innovative learning in combination with different knowledge applications, and improve knowledge application ability. The combination of learning and practice highlights the practical characteristics of college Chinese courses in application-oriented colleges and universities, and requires teachers to appropriately increase the proportion of practical teaching and complete the innovation of teaching methods through various modules such as the social practice module, the special skill module and business synthesis module. The combination of teaching and learning requires teachers to change their teaching ideas, carry out teaching work according to students’ learning needs, make the teaching methods fit the characteristics of students’ practical learning and independent learning, and provide corresponding channels for them to acquire knowledge and skills.

On this basis, teachers also need to strengthen the exploration of practical and directional teaching methods, to make the curriculum reform fit the needs of students’ career development and learning rules. Through the innovation of teaching methods, teachers promote the reform of college Chinese curriculum and enhance the directivity of its content, which is a response to the needs of students’ application ability training, vocational core quality and education development. Teachers can appropriately streamline the basic courses in the theoretical teaching of college Chinese to meet the standard of “sufficient,” and appropriately increase the practical teaching content, highlighting the characteristics of “being a person + skills + knowledge” in the training of talents in application-oriented colleges and universities, to provide a corresponding learning field for students to achieve all-round development and grow up to provide new people in the era^[15].

4. Conclusion

To sum up, combined with the talent training orientation of application-oriented colleges and universities, application-oriented college Chinese courses need to balance the relationship between “application” and “academic,” provide services for students to master the basic theoretical knowledge and the ability to use the theoretical knowledge to innovate and practice, and help them grow into application-oriented talents needed for the transformation and upgrading of various fields and seek a way to break the current situation. This requires teachers to pay attention to the connection between talent training and industry development needs, optimize teaching methods and contents from the perspective of vocational core literacy education, and accelerate curriculum reform by adopting different strategies such as restructuring college Chinese teaching objectives, integrating basic learning and skill-based learning, and innovating teaching implementation methods for students’ employment.

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References

- [1] Niu Y, 2024, Research on Optimization Strategies of College Chinese Classroom Teaching in Applied Undergraduate Universities—A Case Study of Huanghe Jiaotong University. *Knowledge Window (Teachers Edition)*, 2024(3): 12–14.
- [2] Zhang X, 2024, Teaching Effect Evaluation and Innovation Exploration of College Chinese Courses in Applied Universities. *Modern Vocational Education*, 2024(6): 153–156.
- [3] Kou Y, 2019, Reading Teaching Reform Path of “Chinese Modern and Contemporary Literature” Course—A Case Study of Chinese Majors in Applied Universities. *Western Quality Education*, 10(2): 9–12.
- [4] Li R, Yang X, Zhang J, 2023, Teaching People with Poetry, Touching People with Emotion, Educating People with Aesthetics and Educating People with Culture—A Research on Ideological and Political Teaching Practice of College Chinese Course in Applied Colleges and Universities. *Chinese Character Culture*, 2023(22): 47–49.
- [5] Li J, 2023, A Study on the Curriculum Reform of College Chinese in Applied Universities—Taking “Practical Writing” as an Example. *Journal of Hubei Open Vocational College*, 36(17): 186–187 + 193.
- [6] Li R, Yang X, Zhang J, 2022, Construction and Practice of Virtual Teaching and Research Office of College Chinese Course in Applied Universities—A Case Study of Western Yunnan University of Applied Technology. *Chinese Character Culture*, 2022(24): 39–41.
- [7] Li H, Li H, 2024, Research and Practice of College Chinese Teaching in Local Universities from the Perspective of National Standard Chinese Language Promotion. *Writers’ World*, 2024(1): 58–60.
- [8] Wang X, 2023, Research on Dilemma and Countermeasures of “College Chinese” Course Training Applied Talents in Higher Vocational Colleges. *Journal of Guizhou Open University*, 31(4): 37–41.
- [9] Zhang Y, 2023, Research on the Teaching Practice of Integrating Aesthetic Education into the Teaching of College Chinese in Higher Vocational Colleges—Taking the Teaching of Pipa Song as an Example. *Journal of Hubei Open Vocational College*, 36(24): 170–172.
- [10] Tuo M, 2023, Design and Practice of Mixed Teaching of “College Chinese” under the Concept of Deep Learning. *Journal of Anhui Electronic Information Vocational College*, 22(4): 34–37.
- [11] Li Y, 2023, Exploration on the Integration of Chinese Traditional Aesthetic Education Culture and Chinese Teaching in Higher Vocational Colleges. *Writer’s World*, 2023(35): 49–51.
- [12] Li X, 2023, Exploration and Innovation of College Chinese Teaching under the Background of New Liberal Arts Construction. *Chinese Character Culture*, 2023(S1): 80–82.
- [13] Wang X, 2023, An Analysis on the Path of Deep Integration of Excellent Traditional Chinese Culture and College Chinese Teaching. *Jia Ying Literature*, 2023(23): 141–143.
- [14] Pang F, 2023, The Convergence and New Changes of College Chinese—A Review of the Papers of the 5th National College Chinese Forum. *Chinese Character Culture*, 2023(23): 3–5.
- [15] Wang H, 2023, Research on College Chinese Course Teaching in Higher Vocational Colleges Based on Results-Oriented Theory. *National Standard Language Teaching and Research*, 2023(11): 118–120.

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Study Style Construction Path of College Students under the Background of “Five education”

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Abstract: “Five education” is a new education concept in recent years. It is a guide for the development and construction of higher education in the right direction and provides new ideas and directions for the construction of college students’ study. Further to the exploration of related strategies, and take the forensic students as the main research body to analyze with examples, in order to improve the quality and effectiveness of the construction of forensic students’ study style, better adapt to the “Five education” for higher education development needs, further improve the quality of personnel training, and transport high-quality talents for our country’s legal construction.

Keywords: Construction of academic style; Five education; Strategy analysis

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1. Introduction

“Five education” is a new concept of modern education development and construction, the fundamental direction of China’s education reform in the new era, and a new talent training requirement. Colleges and universities should follow the pace of development of the era, build a multi-level, comprehensive and systematic style of study system based on “Five education” during the construction of students’ style of study, and effectively promote the all-round development of students’ comprehensive quality. To train qualified builders and successors for the construction of socialism with Chinese characteristics ^[1].

2. Discussion of relevant concepts

2.1. The concept of “Five education” and the construction of the style of study

“Five education” is the modern education concept of the era and development of the performance, fully reflecting the students of the social value and personal development of the value of the unified requirements, showing the harmonious and free development of human and nature characteristics. The five aspects of “Five educations

simultaneously” refer to moral education, intellectual education, physical education, aesthetic education, and labor education, aiming to realize students’ all-round development through five dimensions of moral guidance, intellectual education, physical education, aesthetic education and labor education practice^[2].

Student construction is a comprehensive educational management activity, which is more or less related to all levels of the school. It requires the school, students and teachers to create a good learning atmosphere in the learning process through environment, system, culture, and other means. It includes both soft environment, such as teaching attitude and educational principle, and hard environment, such as learning order and learning atmosphere. The construction of learning style has the characteristics of dynamic and systematic. On the one hand, the construction of learning style is not static, but constantly adjusted according to the development of the era and social needs. On the other hand, the construction of learning style is a complex project, which needs to involve various contents such as school management, teacher teaching, ideological and political work, so relevant departments need to make an overall plan.

2.2. The relationship between “Five education” and the construction of the style of study

There is a correlation between the teaching concept of “Five education” and the construction of study style, which makes the background of “Five education” a powerful boost to the construction of study style, and can further enhance the effectiveness of the construction of study style.

First, both the “Five education” and the construction of the style of study point to the cultivation of students, emphasizing the comprehensiveness of student development and college talent training. It is not only necessary to pay attention to students’ professional ability and skills, but also to ensure the development of students’ ability, and jointly commit to cultivating excellent new people of the era. Second, the “Five education” and the construction of the style of study are related to each other in the educational connotation. Higher education is a society-oriented education and a talent education for the development of the country. The concept of “Five education simultaneously” always runs through the people-oriented teaching concept and sticks to the original mission of educating people for the country. From this point of view, the construction of the style of study is the external manifestation of the concept of “five education and simultaneous education”, and it is also the integration of the component of the education system with “five education and simultaneous education” as the core^[3]. Thirdly, “Five education” and the construction of the style of study can learn from each other. The proposal and application of the concept of “Five education” is in line with the actual situation and basic law of the current development of college students, and highly matches the objective conditions needed to cope with the construction of study style. The two can learn from each other when exploring specific strategies and paths, to realize the same direction, complement each other, improve each other, and go forward hand in hand^[4].

3. The value and significance of the construction of academic style in colleges and universities under the background of “Five education”

3.1. The necessity of the construction of a college-style of study

The construction of academic style has always been an important part of the development of colleges and universities. Although considerable achievements and progress have been made with the support of modern educational concepts and means, there are still many problems. How to effectively improve the quality of the construction of academic style and ensure its effectiveness in student development and personnel training is still under constant exploration and practice. There is a certain correlation between the implementation of the concept

of “Five education” and the construction of the style of study. The proposal and application of this idea have a positive impact on the construction of the style of study. Specifically, there are some problems in the construction of study style in colleges and universities, such as unclear value orientation, poor linkage of education subjects, and integrity and systematization of the construction system to be improved. The application of the concept of “Five education” in the construction of study style points out the development direction and speeds up the work process ^[5].

First, the construction of academic style emphasizes many aspects. In the actual operation process, to ensure the balanced development of all aspects, there may be a problem of multiple parallel lines, but the main line is blurred, resulting in unclear orientation of education and difficult to play its real value. The “Five education” emphasizes the prominent role of moral education in the development of students, uses moral education to lead the development of students’ ideas and beliefs, and optimizes the educational function in student construction.

Second, the construction of the style of study needs the concerted efforts of multiple subjects, such as teachers and students, full-time teachers and counselors, and other subjects should realize the interconnection and interoperability to ensure the construction and development of the joint efforts of education. However, at present, there is still a phenomenon of mutual alienation among various subjects, and they do not have a comprehensive and thorough understanding of their responsibilities and obligations, and have not formed a good pattern of making up for and complementing each other ^[6]. Due to the consideration of performance and promotion, many teachers still attach importance to their work and ignore the construction of their study style. However, the background of “Five education” puts forward clear requirements for each subject, prompting the school to clarify the specific responsibilities and evaluation standards of each subject, so as to ensure the effectiveness of the construction of study style.

3.2. Feasibility of the construction of academic style in colleges and universities

First of all, national policies provide relevant guarantees. The teaching concept of “five education at the same time” is vigorously advocated by the state at the educational level. Based on this concept, the state attaches great importance to moral education, physical education, aesthetic education and labor education in addition to intellectual education of college students. It is comprehensive and multifaceted, and coincides with the requirements and concepts of the construction of academic style in colleges and universities, and plays an important role in the cultivation of students’ abilities. Secondly, the educational concept of “Five education” is consistent with the target price of college talent training. “Five education” reflects the teaching concept of comprehensive education, which can meet the requirements of diversified development of students, provide students with a richer and more novel learning experience, consistent with the overall planning of the construction of learning style.

Finally, “Five education” provides a new method and path for the construction of college-style of study ^[7]. On the one hand, the teaching concept of “Five education” can build a more perfect teaching evaluation system, shift the traditional teaching focus based on knowledge to capacity building and quality training, provide a necessary guarantee for the construction of study style, and promote the formation of a good study style. On the other hand, “Five education” can coordinate various subjects to provide more and richer resources for the construction of academic style in colleges and universities, such as linking the physical education department, art department, logistics department, etc., to realize the induction and integration of teaching resources, create a good learning atmosphere in an all-round way, and improve the effectiveness of the construction of academic style.

4. The realization path of the construction of academic style in colleges and universities under the background of “Five education”

4.1. Strengthen practical activities and expand comprehensive quality

Practical activities play an important role in promoting the construction of academic style in colleges and universities. They play a positive role in cultivating students' spirit of innovation, sense of social responsibility, and improving their ability to solve practical problems. They can enable students to deeply understand and apply professional knowledge in practical practice, broaden their view of major fields, and cultivate their awareness of deep thinking, exploration and application, thus forming good learning habits and atmosphere.

First of all, practice the characteristics of “five education” and construct theoretical courses. Forensic professional talent training is a systematic process. To better integrate into the requirements and concepts of “five education”, teachers can help students improve their comprehensive qualities at all levels more systematically and comprehensively through the curricular form, and integrate the construction of learning style in the curricular process^[8]. Moral education is the first of the five educations, which can be taken as the core content of the curriculum, supplemented by aesthetic education, labor education and other educational elements. Special courses can be created to help students learn related content in depth in the form of compulsory courses, to achieve individualized teaching and precise teaching. At the same time, teachers can also integrate the form of five education knowledge into the curriculum of forensic medicine, and cultivate students' correct worldview, life and moral values in an imperceptible way. After penetrating socialist core values and Marxist theory, only by laying a solid ideological foundation can they more actively participate in professional learning and create a good learning atmosphere^[9].

Secondly, through the concept of “Five education,” create practical projects. Social practice is also a powerful means to improve the effectiveness of the construction of students' style of study. Schools can create rich campus cultural activities and practical projects, so that students can improve the quality of “Five education” in practice and optimize the construction of study style in practice. The teaching of forensic medicine specialty has certain professionalism and particularity. In the construction of professional practice projects, we can start from the characteristics of the specialty, change the standards according to the requirements of the construction of study style, and set practical activities related to the professional development of students. Schools can also build targeted campus cultural activities according to students' learning needs. Based on comprehensive qualities of morality, intelligence, physical fitness, the United States and labor and professional development, diversified and multi-level practical activities can be set up to create a positive cultural environment on campus, guide students to form a good spiritual quality, and guide the formation of the construction of academic style. For example, the school can cooperate with the judicial authorities to carry out legal knowledge lectures and moot court activities, and then simulate the real legal environment for students with the help of virtual reality technology, and immerse themselves in learning legal procedures and ethical norms, so that students can improve their five education qualities and strengthen the construction of study style in practice^[10].

4.2. Improve system construction and strengthen comprehensive management

The system is the cornerstone to ensure the continuous and steady progress of the construction of academic style. Perfect system construction is conducive to strengthening comprehensive management, further improving students' five education literacy, and thus promoting the construction of academic style in colleges and universities. This enlightens colleges and universities, in order to realize the deep integration of the “Five education” prospect and student construction, they should formulate clear rules and regulations for the

construction of study style, including student behavior norms, teacher team construction, and sound incentive and restraint mechanisms, so as to provide corresponding guidelines for students' study and life, and guide students and teachers to consciously strengthen the five education literacy through institutional guidance and restraint. Maintain a good academic atmosphere. The educational concept of "Five education" provides scientific and clear direction and ideas for the institutionalization of the construction of academic style ^[11].

First, we should pay full attention to the value and significance of each subject in the construction of the style of study, and realize collaborative management based on the perspective of the subject. There are many subjects involved in the construction of the style of study, including not only students, but also teachers such as counselors, professional teachers and class teachers, as well as students' parents, students' party building organizations, and off-campus education resources. Scientific planning should be carried out for each subject to better gather the joint force of the construction of the style of study.

Second, we should pay attention to the integration of "Five education" and professional teaching. "Five education" involves many aspects, which is also a process of mutual coordination and dynamic integration. Teachers should coordinate these aspects to achieve mutual integration with forensic science courses, so that students can realize the integration and penetration of "Five education" under the guidance of all aspects, the whole process and all staff, and help the construction of academic style in colleges and universities ^[12]. In the specific practice process, the school level should give full play to the advantages of top-level design and overall consideration, integrate the construction of learning style into the system construction, and run through the integrated process of teaching, management and service, so that students, faculty and even off-campus education organizations can clearly define their responsibilities, and form a education pattern with clear division of labor and joint management. In order to strengthen the teaching quality assurance system, teaching evaluation and other aspects of the study style construction and "Five education" of the linkage and integrity, to promote the formation of an excellent campus culture.

4.3. Build a network system to achieve multi-party interaction

In the process of the construction of college students' style of study, it is necessary to involve multiple subjects, and strengthening the interconnection of multiple subjects is conducive to promoting the circulation and sharing of information, enhancing the cooperation and cooperation among various subjects to jointly promote the in-depth development of the construction of style of study.

First of all, the school level can make use of the teaching concept of "curriculum thinking and politics", integrate moral education into professional teaching, build a teacher team of ideological and political teachers and professional teachers to cooperate, and promote the significance and value of "Five education" in the construction of study style. Ideological and political teachers can help professional teachers to integrate targeted ideological and political education content in the professional teaching process. It can also realize the linkage between ideological and political teachers and counselors, carry on continuous penetration to students in daily life, create a dynamic talent training model, and improve the effectiveness of the construction of learning style ^[13].

Secondly, in order to further enhance the depth and breadth of "Five education" in the construction of the style of study, colleges and universities can also rely on the network, across the boundaries of time and space, to build a network system with the characteristics of the era. The advantage of taking the network as a new education and teaching position is that the diversity and richness of network resources can help students broaden their horizons. Intelligent teaching methods such as online learning and communication, and discussion can bring students a more novel teaching experience, better stimulate students' learning enthusiasm, initiative, and

creativity, and build a more information-based education matrix with the characteristics of the era. It should be noted that the network is always a double-edged sword. While applying the network teaching, teachers should enhance students' awareness of self-education and self-management, correctly understand the network world, strengthen students' awareness of network civilization and academic integrity, and let the network play a positive role in the construction of learning style ^[14].

5. Conclusion

To sum up, the construction of academic style has a close and direct connection with the growth of each student. As practitioners of the future legal career, as an important defender and executor of national development and construction, forensic students should pay more attention to the quality of training and the construction of academic style. The construction of academic style in colleges and universities is a long-term, complex, and systematic project, and the time path also shows the characteristics of multi-forms and multi-carriers ^[15]. "Five education" is a new direction of education and teaching reform in recent years, emphasizing the comprehensive development of students' comprehensive ability, which is a new turning point for the construction of college study style to realize the development of colleges and universities. Strengthening the construction of the style of study against the background of "simultaneous development of the Five education" is an inevitable way for the development of education and the era. Colleges and universities should deeply interpret the concept and correlation of "Five education" and the construction of the style of study, rely on the actual situation of the education work in colleges and universities, deeply analyze its feasibility and necessity, explore the realization path, innovate construction methods, and optimize the work system of the construction of the style of study. To contribute wisdom and strength to the realization of high-quality development of higher education, and to cultivate high-quality talents with both morality and talent for the Chinese dream of the great rejuvenation of the Chinese nation.

Disclosure statement

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References

- [1] Xiao X, Li Z, 2024, Exploration on the Construction Path of Academic Style in Colleges and Universities from the Perspective of "Three Whole Education." *Popular Literature and Art*, 2024(23): 154–156.
- [2] Li T, Zheng G, 2024, Three Applied Academic Discipline Construction in the Concept of the Whole Education Community Path to Explore. *Journal of Jinzhou Medical University (Social Science Edition)*, 22(6): 90–93 + 97.
- [3] Li B, Jiao Y, 2024, Research on the Construction Strategy of Academic Style in Higher Vocational Colleges—Based on the Concept of "Four Qi and Five Taste." *Journal of Beijing Vocational College of Political Science and Law*, 2024(4): 111–114.
- [4] Sun W, 2024, The Synergistic Development of Scientific Research Education and Study Style Construction: The Logical Path and Integration Path. *Modern Education Science*, 2024(6): 59–65.
- [5] Xiong S, 2024, Analysis on the Path of Study Style Construction in Higher Vocational Colleges from the Perspective of "Five and Education Simultaneously." *Modern Vocational Education*, 2024(31): 81–84.

- [6] Zhou M, 2024, Exploration and Practice of the Construction of Academic Style in Colleges and Universities from the Perspective of “Three Whole Education.” *China Transition from Military to Civilian*, 2024(19): 175–176.
- [7] Yang M, Deng L, 2024, Construction of Academic Style Construction Model in Higher Vocational Colleges under the Concept of “Three All Education.” *Academy of Education*, 17(27): 60–62.
- [8] Tian G, Li T, 2024, Study Style Construction into the Comprehensive Reform of “Three Full Education.” *Reference for Middle School Political Teaching*, 2024(36): 17–19.
- [9] Lin Y, Wang W, 2024, Hot Spots and Inspirations on the Construction of Academic Style in Chinese Universities: Based on Knowledge Graph Visualization. *Journal of Anhui Electronic Information Vocational and Technical College*, 23(3): 104–110.
- [10] Hu S, 2024, Optimization Path of Academic Style Construction in Colleges and Universities under the Pattern of “Great Thinking and Politics.” *Taste · Classics*, 2024(15): 98–101.
- [11] Xu L, Liu Z, 2024, Spirit into the Practice of the Construction of the Academic Discipline Path. *Modern Trade Industry*, 2024(14): 120–122.
- [12] Xing J, Hao G, 2024, Research on Long-Term Mechanism of Academic Style Construction in Universities Based on the Concept of “Three Whole Education.” *University Education*, 2024(10): 18–22.
- [13] Li J, 2024, Higher Vocational Colleges Based on the Concept of “Education and” Style of Study Construction Path. *Industrial Technology and Vocational Education*, 22(2): 99–102.
- [14] Chang F, 2024, Research on the Construction of Academic Style in Colleges and Universities under the Concept of Three Educations—A Case Study of a University in Wuhan. *Modern Trade Industry*, 2024(10): 238–240.
- [15] Deng Y, 2024, Research on the Characteristics and Path Innovation of Academic Style Construction in Colleges and Universities from the Perspective of “Three-Whole Education.” *Peking University Press Co., LTD. Proceedings of the Seminar on College Counselor Team Construction in 2024*, Nanchang Hangkong University, 5.

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Opportunities and Challenges of Teaching Non-English Majors of Higher Vocational Education Spoken English in the Artificial Intelligence Era

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Abstract: This article is a discussion of applying artificial intelligence to the spoken English teaching of non-English majors in higher vocational education. First of all, the history of artificial intelligence, as well as guidance about applying artificial intelligence to education, was reviewed. Secondly, the status quo of spoken English teaching in higher vocational education was investigated from both the teachers' and students' perspectives. Thirdly, both ample opportunities and tough challenges of spoken English teaching in higher vocational education, which were presented by artificial intelligence, were analyzed. Lastly, suggestions for dealing with the tough challenges were proposed.

Keywords: Artificial intelligence; Higher vocational education; Non-English majors; Spoken English

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1. Artificial intelligence

1.1. The history of artificial intelligence

The founding period of artificial intelligence was from the 1930s to the 1950s. The Turing machine laid the theoretical foundation for modern computers in 1936. The neural network, which laid the base for its field, was put forward in 1943. As a term, artificial intelligence was initially proposed at the Dartmouth conference in 1956, marking artificial intelligence as a separate research field.

The first wave of artificial intelligence was from the 1950s to the 1970s. Logic theorist, which was the first automated reasoning computer program, was written by Newell *et al.* in 1956^[1]. DENDRAL, the first expert system, was developed by Feigenbaum *et al.* in 1965^[2]. ELIZA chatbot, a natural language processing program, was created by Weizenbaum in 1966^[3].

The first artificial intelligence winter was from the 1970s to the 1980s. Lighthill^[4] published a report in 1973, criticizing that research on artificial intelligence lacked actual progress. The researchers generally over-promised; however, due to both technical and theoretical constraints of that time, they under-delivered, causing huge gaps between promises and realities of the artificial intelligence field, which led to funding cuts.

The second wave of artificial intelligence was from 1980 to 1987. With the progress of the expert system and the neural network, the artificial intelligence field came into its second development period. Machine learning became an independent research field, leading to various machine learning algorithms. Meanwhile, natural language processing research was also moving forward.

The second winter of artificial intelligence was from 1987 to 1993. The market for specialized LISP-based hardware collapsed in 1987. Additionally, the expert system failed in a commercial application. Funding for the artificial intelligence field was decreased.

The third wave of artificial intelligence was from the 2000s to the present. The wide use of the Internet and mobile devices has generated a tremendous amount of data. With the improvement of computing power, computers were capable of processing big data, achieving a breakthrough in deep learning, which assisted the advancement of machine learning.

1.2. Guidelines on applying artificial intelligence in education

Nowadays, artificial intelligence is widely used in different fields, and there is no exception to the education field. The application of artificial intelligence in education provides unprecedented opportunities for coping with challenges in the field; nevertheless, it also poses unknown risks.

There are a series of publications of UNESCO (United Nations Educational, Scientific and Cultural Organization), which guide the application of artificial intelligence in education. “Beijing Consensus on Artificial Intelligence and Education”^[5] the first guideline on applying artificial intelligence in education, was published by UNESCO in 2019. UNESCO published “Guidance for Generative AI in Education and Research”^[6] in 2023, which was the first guideline on using generative artificial intelligence in education. “AI Competency Framework for Teachers”^[7] and “AI Competency Framework for Students”^[8] were published by UNESCO in 2024, which initially provided competency frameworks for both teachers and students in the artificial intelligence era.

With the rapid advancement of artificial intelligence, China released a series of guidelines on using artificial intelligence in various fields. The Ministry of Education of the People’s Republic of China has published a series of reports, guiding the application of artificial intelligence in education. The Ministry of Education of the People’s Republic of China published “The Action Plan of Artificial Intelligence Innovation in Higher Education”^[9] in 2018, which regulated technology innovation, talent development, and international cooperation in the artificial intelligence field in higher education. “Suggestions on Accelerating the Fusion of Subjects and the Training of Graduate Students in the Artificial Intelligence Field under Double First-Class Construction”^[10] was released by Ministry of Education of the People’s Republic of China in 2020, which provided guidelines for subject and talent development of artificial intelligence in higher education.

2. The status quo of spoken English teaching in higher vocational education

2.1. Spoken English teaching status quo

According to “The Basic Requirements Index for Running Colleges and Universities (Trial)”^[11], the student-to-teacher ratio in higher vocational education should be 18:1. “Statistical Report on China’s Educational Achievements”^[12–15] from 2020 to 2023 (**Figure 1**), released by The Ministry of Education of the People’s Republic of China, showed that the student-to-teacher ratio in higher vocational education was getting close to 18:1 but had not reached the requirement of 18:1 yet in 2023. Therefore, the current student-to-teacher ratio can still be improved.

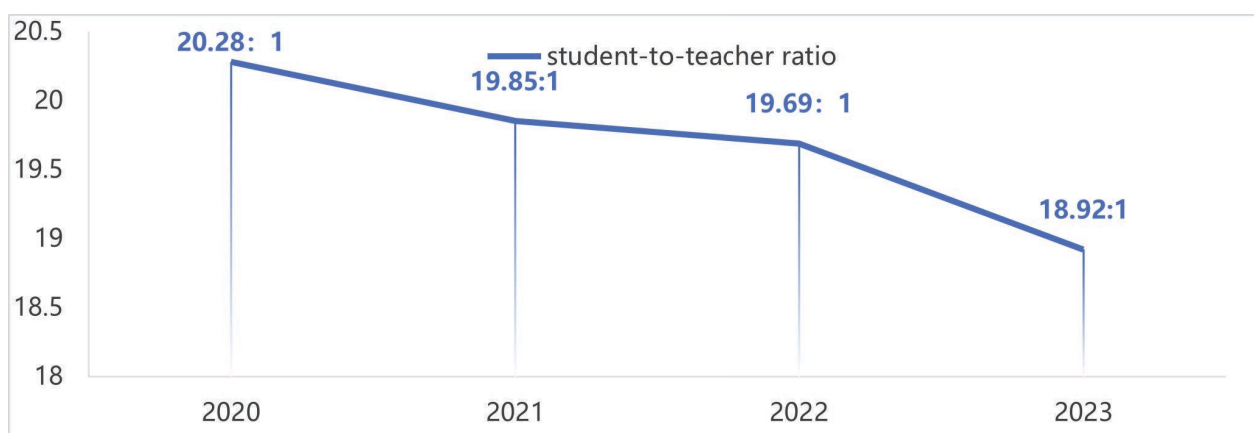


Figure 1. National student-to-teacher ratio in higher vocational education from 2020–2023.

As stated in “The English Course Standards for Higher Vocational Education (2021 Edition)”^[16], English courses for non-English majors should foster students’ skills in learning and using English. In order to meet the requirements for students’ spoken English ability in “The English Course Standards for Higher Vocational Education (2021 Edition),” student-centered education philosophy should be adopted in spoken English teaching for non-English majors, but it takes time to change teachers’ teaching philosophy. Although the reform of educational philosophy has been carried out in recent years in China, a large number of English teachers, who teach non-English majors spoken English, currently still employ teacher-centered teaching methods that are ineffective with regard to improving students’ spoken English ability. Additionally, the lack of spoken English teaching facilities is also a major factor that impedes the desired results of spoken English teaching.

2.2. Spoken English learning status quo

High school graduates, secondary vocational graduates, veterans, etc., are the student sources of higher vocational colleges and universities. Students’ English levels are in strong contrast with one another with respect to group levels and individual levels because of the diverse student sources^[17]. For example, high school graduates are usually better than secondary vocational graduates when it comes to English basics. The complexity of student sources is having a negative impact on spoken English teaching for non-English majors in higher vocational education.

The learning motivation of non-English major students in higher vocational education has a significant influence on their spoken English learning. English courses for non-English majors are usually offered for the first year. However, this period is an adjustment time for students to get used to their college life, and a lot of them haven’t had clear plans for their future yet, which generally means that they don’t have a strong motivation for learning spoken English.

Student-centered education philosophy is required in higher vocational education, and all teaching activities should be student-oriented. Nonetheless, most non-English majors were taught in teacher-centered teaching methods before their higher vocational education level. Therefore, when they first encounter student-centered teaching methods in their English courses, it will be hard for them to adjust. For instance, if students are asked to make spoken dialogues in English when they weren’t trained in spoken English, they will feel nervous or even intimidated.

3. Opportunities and challenges of teaching non-English majors of higher vocational education spoken English in the artificial intelligence era

3.1. Opportunities of teaching non-English majors of higher vocational education to speak English in the artificial intelligence era

The rapid advancement of artificial intelligence has a profound impact on various fields. The impact of artificial intelligence on education is one of the hottest topics globally. There are new opportunities for addressing the biggest challenges with the emergence of artificial intelligence. Teaching non-English majors to speak English hasn't achieved the expected results due to the limitations of teaching facilities and teaching resources. With the coming of the artificial intelligence era, there are more feasible solutions to cope with the limitations of teaching spoken English in higher vocational education.

Artificial intelligence applications can be used in different kinds of mobile devices, which can help to deal with the lack of spoken English teaching facilities in higher vocational education. Additionally, when learning spoken English, students can have an immersive learning experience by using artificial intelligence, which will help them to overcome limitations of time and location. Artificial intelligence will help to offer students personalized support in spoken English learning under their personal English levels, despite the diverse student sources and the differences among students as a group and individuals^[18]. Furthermore, personalized support will assist students in overcoming their nervousness or fear when they practice and use spoken English. When speaking English, students will have a sense of achievement owing to their personalized support by artificial intelligence, and this sense of achievement will further motivate them; as a result, their spoken English will be enhanced.

Teachers are capable of collecting non-English majors' spoken English data by using artificial intelligence; therefore, they can have a more precise understanding of students' spoken English levels, which enables them to provide more personalized guidance to students. Besides, teachers can use artificial intelligence to create spoken English exercises that are closer to students' real lives and more of today to help students feel more related to the exercises^[19]. Meanwhile, with the assistance of artificial intelligence, teachers can help students maintain their interest in learning spoken English by providing prompt feedback on their spoken English exercises.

3.2. Challenges of teaching non-English majors of higher vocational education to speak English in the artificial intelligence era

The application of artificial intelligence in education indeed provides new opportunities for addressing the biggest challenges in the field, but it also poses new challenges. Teaching non-English majors to speak English in the era of artificial intelligence faces unprecedented challenges.

Artificial intelligence can create a large amount of spoken English exercises within minutes, but these fast-produced materials lack accuracy because, at the time being, there are no effective systems that supervise them at all. There are important limitations of the artificial intelligence field regarding natural language processing and speech recognition. The existing artificial intelligence technologies can't provide students with real spoken English simulation settings. Moreover, when students communicate with each other verbally, it is not only about informational communication but also about emotional and interpersonal communication. The application of artificial intelligence in spoken English teaching may lead to students' emotional absence and may also cause students' dependency on artificial intelligence when it comes to interpersonal communication.

Independent critical thinking and personal growth are the main purposes of education, yet the existing

artificial intelligence technologies can only provide students with feedback on their spoken English exercises based on their scores. Furthermore, ensuring information security and protecting teachers' and students' privacy is still an unsettled issue, given that artificial intelligence applications will collect a lot of personal information of teachers and students while assisting teachers and students in spoken English exercises.

4. Suggestions

First and foremost, effective supervising systems for the application of artificial intelligence in education should be developed. Spoken English exercises in higher vocational education that are generated by artificial intelligence should be under supervision so as to ensure their accuracy.

Second, offering students more real spoken English simulations by advancing the natural language processing technology and speech recognition technology. Clear arrangement of the roles of teachers and artificial intelligence applications plays an important role in avoiding students' emotional absence and lack of interpersonal communication.

Last but not least, when assessing students' spoken English abilities, formative assessment should be considered because this type of assessment will facilitate students' all-around development rather than only focus on their scores. Laws and regulations, which specify legal responsibilities of data collection and data usage by artificial intelligence applications, should be made as soon as possible to ensure the information security of teachers and students, as well as to protect their privacy.

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References

- [1] Newell A, Simon H, 1956, The Logic Theory Machine: A Complex Information Processing System. IRE Transactions on Information Theory, 2: 61–79.
- [2] Lindsay RK, Buchanan BG, Feigenbaum EA, 1993, DENDRAL: A Case Study of the First Expert System for Scientific Hypothesis Formation. Artificial Intelligence, 61(2): 209–261.
- [3] Weizenbaum J, 1966, ELIZA—A Computer Program for the Study of Natural Language Communication Between Man and Machine. Communications of the ACM, 9(1): 36–45.
- [4] Agar J, 2020, What Is Science for? The Lighthill Report on Artificial Intelligence Reinterpreted. The British Journal

for the History of Science, 53(3): 289–310.

- [5] UNESCO, 2019, Beijing Consensus on Artificial Intelligence and Education. International Conference on Artificial Intelligence and Education, Planning Education in the AI Era: Lead the Leap, United Nations Educational, Scientific and Cultural Organization, Paris.
- [6] Miao FC, UNESCO, Holmes W, 2023, Guidance for Generative AI in Education and Research, United Nations Educational, Scientific and Cultural Organization, Paris.
- [7] Miao FC, UNESCO, Cukurova M, 2024, AI Competency Framework for Teachers, United Nations Educational, Scientific and Cultural Organization, Paris.
- [8] Miao FC, UNESCO, Shiohira K, 2024, AI Competency Framework for Students, United Nations Educational, Scientific and Cultural Organization, Paris.
- [9] Ministry of Education of the People's Republic of China, 2018, The Action Plan of Artificial Intelligence Innovation in Higher Education, Ministry of Education of the People's Republic of China, Beijing.
- [10] Ministry of Education of the People's Republic of China, 2018, Suggestions on Accelerating the Fusion of Subjects and the Training of Graduate Students in the Artificial Intelligence Field under Double First-Class Construction, Ministry of Education of the People's Republic of China, Beijing.
- [11] Ministry of Education of the People's Republic of China, 2004, The Basic Requirements Index for Running Colleges and Universities (Trial), Ministry of Education of the People's Republic of China, Beijing.
- [12] Ministry of Education of the People's Republic of China, 2020, Statistical Report on China's Educational Achievements in 2020, Ministry of Education of the People's Republic of China, Beijing.
- [13] Ministry of Education of the People's Republic of China, 2021, Statistical Report on China's Educational Achievements in 2021, Ministry of Education of the People's Republic of China, Beijing.
- [14] Ministry of Education of the People's Republic of China, 2022, Statistical Report on China's Educational Achievements in 2022, Ministry of Education of the People's Republic of China, Beijing.
- [15] Ministry of Education of the People's Republic of China, 2023, Statistical Report on China's Educational Achievements in 2023, Ministry of Education of the People's Republic of China, Beijing.
- [16] Ministry of Education of the People's Republic of China, 2021, The English Course Standards for Higher Vocational Education (2021 Edition), Ministry of Education of the People's Republic of China, Beijing.
- [17] Zhou R, 2015, On the Importance of Spoken English Communication in Higher Vocational English Teaching and Its Improving Strategies. *Asia and Pacific Education*, 2015(19): 157.
- [18] Chen Y, 2024, Research on Higher Vocational English Teaching Development under the Background of Artificial Intelligence. *English Square*, 2024(25): 121–124.
- [19] Yu WT, 2024, Research on the Applied Model of Fusion of Artificial Intelligence Technology and Spoken English Teaching. *Overseas English*, 2024(3): 111–113.

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The Statistical Analysis and Thinking of the Illustration of High School Physics Textbook in Human Education Edition

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Abstract: Select the compulsory part of the 19-person edition of the physics textbook as the research object, adopt the text analysis method and design a double-layer classification model to analyze the illustrations in two dimensions of quantity and content. It is found that the illustration density of the three textbooks is high, exert importance to the value of illustrations. However, there are some shortcomings, such as not adhering to the principle of spatial continuity, too few explanatory illustrations and organizational illustrations, too few portrait historical figures, a lack of expressive force of experimental illustrations, and too few knowledge structure charts. Therefore, some teaching suggestions are put forward.

Keywords: Human teaching version; Senior high school physics; Physics textbooks; Illustrations

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1. Introduction

Illustrations are pictures interspersed in the text to provide background information or to decorate, characterize, explain, and organize the text content ^[1]. They are an important tool for teachers to disseminate knowledge. Through illustrations, students can accept and understand the concepts and contents of the text as soon as possible. Therefore, illustrations, as the second language of textbooks and the intuitive part of textbooks, play a vital role in teaching activities. In the face of constraints, including the limitations of educational resources, teaching equipment, and subject concepts, textbook illustrations can make up for these limitations ^[2]. For example, in poor mountainous areas where there is no multimedia equipment, illustrations become the main educational resource. The 2017 edition of physics curriculum standards for senior high schools requires that textbooks properly deal with the relationship between layout and content, and strive to balance and complement each other; The selection of pictures should be made in the scientific and contemporary aspects; Pay attention to the selection of illustrations, so that it is closely combined with the teaching purpose and teaching content ^[3]. Under such a research background, this paper uses the double-layer classification model to carry on the data statistics and analysis of the illustrations in

the high school physics textbooks for human education edition, and provides suggestions for the use of textbook illustrations and future improvement.

2. Statistics of textbook illustrations

2.1. Selection of statistical objects

The statistical objects are Compulsory 1, 2 and 3 Physics Textbooks of 2019 edition of People's Education Press (hereinafter referred to as the 19-person Edition of Compulsory Physics Textbooks) ^[4-6]. The physics textbooks published by People's Education Press are divided into 9 volumes, and the first 3 volumes are compulsory textbooks, which are well-known textbooks with the largest circulation and the highest usage rate in China, so they are selected as the research object.

2.2. Illustration of quantity statistics

Table 1. Statistical table of the number of illustrations in the compulsory physics textbooks of the 19th edition

	Number of illustrations (pieces)	Number of body pages (pages)	Density of illustrations (sheet/page)
Compulsory 1	200	105	1.90
Compulsory 2	179	105	1.70
Compulsory 3	280	134	2.09

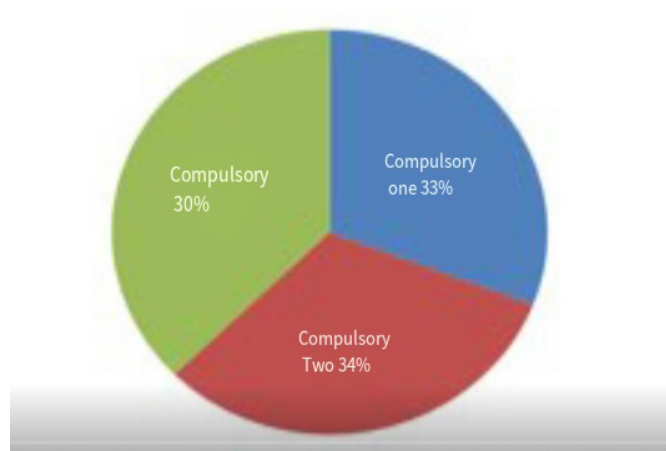


Figure 1. Statistics of the proportion of exercise illustrations in the 19-person edition of the compulsory physics textbook.

There are a total of 674 illustrations in the three textbooks, of which there are 105 pages of text and 200 illustrations in compulsory one, with a density of 1.90 pieces/page; There are 105 pages of text and 179 illustrations in compulsory Course 2, with a density of 1.70 pages/page. There are 134 pages of text and 280 illustrations in compulsory 3, with a density of 2.09 copies/page (**Table 1** and **Figure 1**).

2.3. Analysis of illustration content

2.3.1. Classification basis

In the "Textbook Illustration Analysis Record Table" by Chen Yunbao *et al.*, illustrations are divided into decorative illustrations, representative illustrations, organizational illustrations and explanatory illustrations in

terms of function, and terms of content, illustrations are divided into chapter first diagram, column diagram, text diagram, science and technology life diagram, data diagram, historical data class diagram, guide diagram, experiment diagram, structure diagram and principle simulation diagram^[7]. On this basis and in combination with the characteristics of high school physics textbook illustrations, illustrations are classified twice in terms of content, thus generating the “double-layer classification model” used in this paper, as shown in **Table 2**.

Table 2. Statistical table of the number of various illustrations in the 19-person edition of compulsory physics textbooks

	Decorative type (size)	Representational type (width)				Tissue type (width)		Interpretive type
	Column decoration chart	Chart coordinates	Tech Life chart	Portrait historical data map	Situation cartoon	Experimental drawing	Knowledge structure graph	Schematic simulation diagram
Compulsory 1	5	30	44	16	58	10	3	49
	5 in total		148 in total			13 in total		49 in total
Compulsory 2	5	7	48	6	56	6	0	51
	Total 5		Total 117			6 in total		51 in total
Compulsory 3	6	19	41	8	104	24	4	74
	Total 6		Total 172			28 in total		74 in total

2.3.2. Illustration content statistics

It can be seen from **Table 2** that in the three 19-person editions of compulsory physics textbooks, the representational illustrations occupy the largest proportion and the decorative illustrations occupy the least. With the deepening of learning, the proportion of representational illustrations gradually decreases, while the proportion of corresponding organizational illustrations and explanatory illustrations increases to a certain extent.

3. Analysis of textbook illustrations

3.1. Illustration density analysis

According to statistics, the illustration density of the three volumes of the compulsory part of the 19 teaching version of physics textbooks is 1.90 pieces/page, 1.70 pieces/page and 2.09 pieces/page, respectively, with an average of 1.9 pieces/page. In contrast, the Russian version of Physical Science has a total of 849 illustrations, and the average number of illustrations per page is 1.1^[8]. It can be seen that textbook illustrations are widely used in textbooks in different countries, but the illustration density of the 19-person physics textbook is higher. Nowadays, many researchers have pointed out the value of illustrations, such as H. Levie and R. Lentz looked at 3,155 experiments and came up with the following^[9]: The teaching effect of illustrated textbooks is better than that of pure text textbooks. The group experiment conducted by American scholars Willows^[10] and F.M. Power shows that the reading effect of single-text textbooks and single-illustration textbooks is not very good, and there is no obvious difference between them. The combination of pictures and text textbooks will produce a good effect. On the whole, illustrations are good for reading comprehension, and readers remember illustrated texts more deeply than unillustrated texts^[11]. Therefore, the 19-person version of the compulsory physics textbook is more illustrated than the Russian version of Physical Science, and pays more attention to the value of illustrations in the textbook.

3.2. The proportion of explanatory illustrations and organizational illustrations is too small

As shown in **Table 1**, representational illustrations occupy the largest proportion in the three textbooks, all of which are greater than 60%, while explanatory illustrations and organizational illustrations take the second place, and organizational illustrations do not exceed 10%. The number of representational illustrations far exceeds that of explanatory illustrations and organizational illustrations. Meyer divided the learning process of extracting and processing information into three forms: selection, organization and integration. Decorative illustrations do not influence the above three processes; representational illustrations only affect the selection process, organizational illustrations affect the selection and organization process, and interpretive illustrations affect the selection, organization and integration process^[12]. Among the three types of illustrations, explanatory illustrations have a higher influence and should occupy the highest proportion of textbook illustrations, but the data shows that representational illustrations occupy the highest proportion. It can be seen that the proportion of each type of illustration is not related to its influence in textbooks. The new curriculum reform requires the emphasis on the construction of a knowledge structure system. Illustrations can help students connect old and new knowledge and form a complete knowledge structure system in their minds, while organizational illustrations can connect the knowledge of each chapter in the course more vividly in this process, which plays a role in promoting this process. Therefore, in the arrangement of textbook illustrations, the proportion of explanatory illustrations and organizational illustrations should be appropriately increased.

3.3. Too few portraits of historical materials

According to the data statistics, the average portrait historical figures of science and technology life diagrams in the three textbooks only account for 4.6% on average, and the number of portraits in compulsory courses is only single digits, which is significantly less than other types. Moreover, the historical figures in the three textbooks are mostly simple portraits of people, without providing corresponding thought-provoking text descriptions. However, the portrait historical maps precisely affect the development process of students' physical core accomplishment. First of all, historical portrait maps are important materials in the history of physics, which can help students to immerse themselves in the historical situation and feel the thinking mode of physicists when solving physical problems. Secondly, students' attitudes towards science can be changed through images of scientists. Finally, the use of historical portraits can help students understand the personal charm of physicists, so as to cultivate the scientific spirit of respecting facts, loving science and seeking truth from facts. The four dimensions of core literacy are closely related and influence each other, so we can't ignore the influence of portrait historical maps in the process of cultivating all-round development of people, and the number of portrait historical maps should be appropriately increased.

3.4. There is an illustration of heterotopic

Illustrations complement the text portion of the textbook^[13]. Based on the theory of double coding, Meyer tested the influence of teaching materials on students' learning through controlled experiments, and finally put forward seven principles of multimedia information design. Illustrations that conform to these principles will promote students' mastery and transfer of knowledge^[14]. Among them, the principle of spatial continuity points out that the text content of the illustrations is attached near the corresponding illustrations, but there is an anomaly of the illustrations in the 19 compulsory physics textbooks: some illustrations in the three textbooks are not on the same page as the text, and the principle of spatial continuity is not observed, as shown in one of the illustrations in the textbook, **Figure 10.1-5** in Compulsory Lesson 3. It is suggested that the principle of spatial continuity should be

observed, and the illustrations placed near the text can make the combination of pictures and texts closer, so as to achieve better learning results.

3.5. Experimental illustrations lack expressiveness

Experimental illustrations can create vivid images and experimental scenes, guide students into the world of physics experiments, and help students feel the fun of physics experiments and the importance of practice more directly through them. This plays an important role in the development of students' core literacy. However, almost all experimental illustrations in textbooks simply show the experimental results and instruments, and only use one experimental result diagram or one experimental instrument diagram to represent the whole experiment, which lacks expressive force and does not play the role that experimental illustrations should play. Compared with Japan, there are not only a large number of experimental diagrams in Japanese textbooks, but also emphasis on cultivating students' ability to observe, compare and summarize through experimental diagrams. In addition, most of the experimental diagrams in Japanese textbooks are experimental phenomenon diagrams and experimental operation diagrams, focusing on showing the operation process of the experiment or the comparison of experimental phenomena. Usually, an experiment is represented by multiple continuous illustrations^[7]. They are more expressive. Cognitive psychology surface: In the selection of colors in the compilation of teaching materials, we should fully consider the sensitive colors of human eyes and use these sensitive colors to highlight the main points of illustrations. But in the actual textbook, illustrations are mostly gray and white, almost consistent with the background tone of the textbook, making the illustrations in the textbook not "outstanding," lack of expression. Therefore, while the number of experimental illustrations should be increased, they should be arranged into a series of group drawings reflecting the experimental process, so that students can more easily understand the entire process of the experiment, master the experimental method, and combine the theory and application of what they have learned. At the same time, it is also necessary to use red, yellow, blue and other sensitive colors to make experimental drawings to enhance their expressive force. In addition, it is pointed out in the study that the factors of illustration itself also have an impact on the effect of illustration, and simplified illustration can better promote the understanding and memory of text^[15]. Therefore, when compiling textbooks, the principle of simplicity should be followed, and some concise and purposeful pictures should be selected as textbook illustrations.

4. Discussion

Textbook illustrations play an important role in promoting students' learning. Through the statistics and analysis of this study, the following suggestions are made. First, the illustration density of the 19-person edition of the physics textbook is higher, and more attention is paid to the value of illustrations in the textbook. However, some illustrations do not comply with the principle of spatial continuity. For example, the text of the illustration in **Figure 10.1-5** on page 30 of Compulsory 3 of the 19-person edition of the Physics textbook is located on page 29. It is suggested that teachers should remind students of the location of illustrations when using illustrations in teaching. And guide students to observe the illustrations purposefully, to improve the combination of illustrations and text. Second, in the arrangement of textbook illustrations, it is necessary to appropriately increase the proportion of explanatory illustrations and organizational illustrations, and teachers can also provide students with corresponding materials in class. Third, the number of historical portraits in the textbook is small, which is not enough to provide students with materials history of physics. For example, when learning about Newton's

first Law, in addition to Newton in the textbook, teachers can also provide students with more photos of relevant physicists, especially real-life pictures and experimental pictures. Fourthly, the experimental illustrations in the textbook lack expressive power. To better understand the experimental process, teachers can provide students with more pictures of real experiments. If conditions permit, they can also lead students to carry out experimental exploration in class. Fifth, in the arrangement of textbook illustrations: explanatory illustrations, organizational illustrations, and knowledge structure diagrams are few, and the number of knowledge structure diagrams should be appropriately increased in textbook compilation. Teachers can also provide corresponding materials for students in class, such as guiding students to jointly make mind maps of the chapter after the chapter teaching is over. In short, textbook illustrations should reasonably increase the number and adjust the proportion of types, teachers should also make full use of textbook illustrations and play the role of illustrations in promoting learning, but also learn to supplement direct experience for students to make up for the deficiency of textbook illustrations, so as to better serve the teaching.

Disclosure statement

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References

- [1] Han C, 2011, Effective Strategies for the Use of Illustrations in Junior High School English Textbooks, thesis, Shandong Normal University.
- [2] Zhao S, 2010, The Teaching Strategy of “Representation by Pictures” in Physics Textbooks. *Middle School Physics*, 6: 37–39.
- [3] Ministry of Education of the People’s Republic of China, 2018, Curriculum Standard of Physics for General High School (2017 Edition). People’s Education Press, Beijing, 71.
- [4] Institute of Curriculum Materials, Physics Curriculum Materials Research and Development Center, People’s Education Press, 2019, The First Compulsory Physics Textbook for Senior High School. People’s Education Press, Beijing.
- [5] Research and Development Center of Physics Curriculum Materials, Institute of Curriculum Materials, People’s Education Press, 2019, Secondary School Physics Textbook Compulsory Volume 2. People’s Education Press, Beijing.
- [6] Research and Development Center of Physics Curriculum Materials, Institute of Curriculum Materials, People’s Education Press, 2019, Textbook Physics for Senior High School Volume 3. People’s Education Press, Beijing.
- [7] Chen Y, Cao X, Wu H, et al., 2014, A Comparative Study on Illustrations of New Chinese and Japanese Junior High School Physics Textbooks. *Research on Comparative Education*, 36(9): 71–76.
- [8] Li H, 2023, A Comparative Study on Current Chinese and Russian High School Physics Textbooks, thesis, Harbin Normal University.
- [9] Zeng T, 1999, Review of Foreign Studies on Textbook Illustration. *Foreign Education Research*, 1999(3): 20–23.
- [10] Meng S, 2014, A Comparative Study on Illustrations of Chinese Textbooks in Primary Schools Across the Taiwan Straits, thesis, Tianjin Normal University.
- [11] Zhang H, 2010, Effects of Illustration Types and Presentation Styles on Cognitive Load of Junior Middle School Students with Different Cognitive Styles, thesis, Henan University.

- [12] Zhang H, 2010, Study on Illustration of Science Textbooks in Grades 3–6, thesis, East China Normal University.
- [13] Du A, 2010, Classification and Application Strategies of Illustrations in Physics Textbooks. *Teaching and Management*, 10: 73–75.
- [14] Mayer R, 2017, Using Multimedia for E-Learning. *Journal of Computer Assisted Learning*, 33(5): 403–423.
- [15] Sun L, 2013, Feature Analysis and Application Status of “Suke Edition” Middle School Mathematics Textbook Illustration, thesis, Nanjing Normal University.

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Research on the Reform of Mixed Teaching of Cross-school Credit Courses

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Abstract: In recent years, with the continuous advancement of education information technology, the mixed teaching mode of cross-school credit courses has come into being. It not only breaks the geographical restriction of traditional education, but also promotes the sharing and optimal allocation of educational resources ^[1]. Principles of Pedagogy, as the core course of pedagogy, the implementation of cross-school credits is not only an important measure to respond to the call of national education reform and promote the sharing of higher education resources, but also a key path to meet students' personalized learning needs and improve their independent learning ability. At the same time, through the combination of online learning and offline flipped classroom, students can learn according to their own learning rhythm and points, and then comprehensively enhance their learning effect. In this regard, this paper first analyzes the background and significance of cross-school credits of the "Principles of Pedagogy" course, then clarifies the mixed teaching process of cross-school credits, analyzes the effect of teaching reform, and then puts forward feasible teaching suggestions, in order to provide some references for relevant education researchers.

Keywords: Inter-school credit course; Mixed teaching; Teaching suggestion

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1. The background and significance of cross-school credits of Principles of Pedagogy

1.1. Background of cross-school credits of Principles of Education

With the rapid development of education informatization, cross-school credits have become a new educational model, breaking traditional education's geographical restrictions and providing students with a broader learning platform and resources. Principles of Pedagogy, as the basic course of pedagogy, can not only promote resource sharing, improve teaching efficiency but also help students to form a more comprehensive knowledge structure and a broader academic vision ^[2].

Under the background of the current education reform, the implementation of inter-school study credits is the concrete embodiment of responding to the national education policy and promoting the conformal development of higher education. On the one hand, it can meet the needs of students' personalized learning and promote the improvement of students' independent learning ability; On the other hand, it can also promote the

cooperation and exchange among universities and realize the sharing of high-quality educational resources. In addition, the mode of cross-school credit can also stimulate students' interest in learning, and bring new learning experiences to students through the teaching style and teaching methods of teachers in different universities, thus enhancing the teaching effect and providing strong support for cultivating innovative talents^[3].

1.2. The significance of cross-school credits of Principles of Pedagogy

Cross-school credits can effectively make up for the shortcomings of the shortage of existing educational resources. Each school has certain characteristics of educational resources. Through blended teaching, they can be shared with schools and students in need to achieve the goal of complementing and sharing high-quality educational resources to alleviate the problem of a shortage of educational resources in individual schools. In addition, through cooperation with well-known universities at home and abroad, the school can provide teachers and students with rich and high-quality educational resources, broaden their professional vision, and continuously enhance their independent learning ability. In addition, combining blended teaching and cross-school study can better solve the contradiction between short teaching time and more teaching content. Before class, students can learn theoretical knowledge through cross-school courses. In this case, the explanation time of theoretical knowledge in class can be shortened, to better achieve the expected teaching objectives and continuously improve the efficiency of blended teaching. In the process of cross-school study, teachers can timely and fully understand and master students' knowledge grasp, and can visually observe students' learning progress and homework completion through the online platform. On this platform, teachers can carefully design exercises related to knowledge points and moderate in difficulty. As long as students master the corresponding theoretical knowledge, they can quickly complete the exercises assigned by teachers. According to the completion of exercises, teachers can timely understand the students' learning situation, grasp their shortcomings, and give personalized educational guidance. At the same time, teachers can also monitor students' learning activities in real time, to promote their ability to generate lifelong learning and further promote the process of teaching reform.

2. The blended teaching process of cross-school credit courses

2.1. Building a teaching team

Before the formal teaching, each school may select excellent teachers to form a teaching team to communicate on the curriculum objectives, teaching implementation plans, teaching progress, teaching content and evaluation standards. Teachers should also jointly study the curriculum content, teaching objectives and teaching difficulties of different schools, accurately grasp the difficulty of the assessment content, and work out a perfect teaching plan. Among them, the teaching team is responsible for updating and maintaining the blended course content, such as the update of knowledge explanation videos, exam questions, solution analysis and so on. The teaching team is mainly responsible for the development of blended teaching, such as knowledge and skills transfer, marking exam papers and so on. In addition, the teaching team should be familiar enough with the content and resources of the blended courses across schools and be able to use these proficiently to better carry out online Q&A and tutoring^[4].

2.2. Conducting online learning

According to the teaching plan, teachers should reasonably choose the blended teaching platform, share blended teaching resources and cross-school study information with students through the blended teaching platform, and

push relevant reference materials to them, so as to rationally plan their cross-school study and learning process. On the basis of network statistics, students should be guided to conduct self-education, so as to enable them to have a deeper understanding of the content of curriculum knowledge ^[5]. In addition, to carry out intrusive teaching. Teachers can upload videos made in advance on the teaching platform, and when students finish learning a knowledge point, they can automatically unlock the next learning video, which can improve students' enthusiasm for learning. For students with further learning requirements, teachers can design questions with divergent thinking according to the teaching syllabus and provide reference materials; For students with poor learning initiative, teachers can design and discuss in WeChat groups and QQ groups to guide students to learn independently. Finally, teachers can analyze students' learning data through the teaching platform, which makes up for the "one-size-fits-all" defect of traditional classroom teaching ^[6].

2.3. Implementing offline flipped classroom teaching

Teachers should reasonably arrange and implement offline flipped classroom teaching according to the teaching process. In offline flipped classroom teaching, teachers should highlight students' subjectivity, collect and summarize the problems and difficulties encountered by students in online learning, and organize group cooperative learning in offline flipped classroom teaching to conduct in-depth exploration and discussion of these problems and difficulties. In this process, teachers only play the role of guides and mentors, and should adjust the offline teaching content timely according to the results of each group discussion, give instructions and guidance to the learning and discussion at key information points, reasonably grasp the whole group discussion and learning process, and ensure that all students can participate in it ^[7]. After students have mastered certain course knowledge, teachers can guide them to improve their ability to analyze and solve problems by analyzing cases to realize the effective digestion and absorption of course knowledge. In addition, in the specific teaching process, teachers should establish modern education ideas and build a perfect practical teaching system, which integrates basic knowledge, basic skills learning and training as the basis, comprehensive experiments as the core content, and training students' scientific thinking methods, and can promote the all-round development of students' practical operation, analysis and problem-solving abilities. And further enhance their comprehensive literacy ^[8].

2.4. Conduct reasonable course assessment

The traditional classroom evaluation mainly takes the final exam as the main content, and lacks the examination of students' various abilities. Therefore, in the mixed teaching of inter-school credit courses, teachers should not evaluate students' learning effect by a single final score, but should evaluate students' learning performance by implementing the "summative + procedural" method. Among them, the process evaluation includes online completion of learning, offline teaching evaluation, group discussion, homework completion and other indicators, which can avoid the problem that students do not usually learn and "surprise" to deal with the exam at the end of the semester, and can fully mobilize the enthusiasm of students ^[9]. At the same time, teachers can also timely grasp and understand students' learning performance, learning deficiencies, and provide timely feedback to them, so that they can get a greater sense of accomplishment in the learning process. The assessment usually focuses on students' mastery of what they have learned, while in the final assessment it is used to evaluate students' comprehensive application ability. The evaluation index of homework completion is composed of 5–8 project tasks, which are independently selected by students in small groups, with a maximum of 8 participants in each group. The problem analysis, solution, and PPT presentation of the project team members are a reasonable allocation of learning tasks according to the actual situation, and then the final learning results are uploaded to

the learning platform for other students to use for reference and evaluation. In the process of project sharing, each group can begin to discuss the project design, set up a scoring unit in each group, and determine the inter-group scoring according to the scores of each group. In this process, students' ability of expression, cooperation and communication is significantly enhanced, while their practical ability of analyzing and solving problems is also developed accordingly, and the effectiveness of teaching evaluation is continuously improved^[10].

3. Analysis of the results of cross-school credit courses blended teaching reform

First, the independent learning ability of students has been enhanced, and the personalized learning needs have been met. Blended teaching can break the limitations of traditional teaching in time and space, so that students can independently plan and arrange their learning time and learning progress, and can watch teaching videos repeatedly according to their own learning needs, which greatly increases the flexibility and convenience of their learning methods. After the completion of offline learning activities, students can take the initiative to link their theoretical knowledge, independently or as a group to analyze and discuss real life cases, deepen their internalization of the knowledge, so that students can maximize their autonomy and initiative, and meet their personalized learning needs to the greatest extent.

Second, it can effectively activate students' interest in learning and strengthen the effect of blended teaching. By setting open questions, teachers can activate students' interest in learning, motivate them to actively look up relevant materials, think about relevant issues actively, and express and present them logically. This process not only broadens students' horizon, but also enables them to flexibly apply what they have learned and effectively exercise their thinking and expression skills. The teachers adopt the method of "group mutual evaluation + teacher comment", which ensures that students' discussion is not mere formality, improves their practical application ability and encourages their sustainable development in a certain sense. After the end of each class, most students will take the initiative to carry out online and offline independent learning, which changes the situation of students' surprise review before the final exam in traditional teaching, so that they can develop good learning habits^[11].

Third, it can build a diversified assessment and evaluation model to help improve students' comprehensive ability. In the past, when evaluating students' academic performance, the teaching adopted the method of "normal grade + final grade," which failed to establish a complete and clear index, and students often formed a thinking pattern that they would not miss classes and could pass the undergraduate goal by cramming at the end of the semester. In the hybrid teaching evaluation of cross-school credit courses, teachers will adopt diversified evaluation methods and incorporate them into the entire teaching system and teaching process. At the same time, clearer and operable evaluation standards will be formulated. By combining teacher evaluation with student evaluation, process assessment, and result assessment, students will be able to have better learning performance at each stage. Cultivate students' learning quality in every drop, and then continuously improve their comprehensive ability^[12].

4. Suggestions on the hybrid teaching reform of cross-school credit courses

In order to effectively improve the teaching effect, teachers should do the following: First, teachers should change their educational ideas and realize the importance of ensuring the quality of online teaching videos. High-quality teaching video is the key to the success of cross-school credit course mixed teaching. Therefore, each school

should establish a professional video production team according to the actual situation, which is composed of education experts, teachers, information technology talents, video production talents, etc., to ensure the scientific, interesting and interactive teaching videos. Meanwhile, the content of teaching videos for inter-school credit courses should be updated and optimized in time. In order to better meet the learning needs of students, blended teaching is needed, and continue to improve the effectiveness of course teaching ^[13].

Secondly, given the setting of curriculum assessment links, teachers should constantly optimize the assessment methods to ensure that the assessment is more scientific and reasonable. Cross-school blended teaching assessment should not be limited to the memorization and reproduction of theoretical knowledge, but should pay more attention to the generation of students' ability of understanding, analysis, application and innovation, and actively introduce project-based assessment, peer evaluation, self-evaluation and other evaluation methods to comprehensively evaluate students' learning effect and make the evaluation results more comprehensive. In addition, the assessment results should be timely fed back to students to help them understand their learning status and adjust their learning strategies promptly, so as to continuously improve their learning efficiency ^[14].

Finally, to further improve the effect of cross-school blended teaching, teachers of different schools and specialties should actively communicate with each other and build close cooperative relations. For example, teachers should regularly participate in seminars, workshops and other activities, in which they take the initiative to share teaching experience, discuss teaching methods and jointly solve problems encountered in teaching, to effectively improve their teaching ability. At the same time, the school actively encourages teachers to participate in the cross-school teaching team, and constantly improve their teaching ability and professional level through practical teaching practice, so as to efficiently carry out the cross-school blended teaching of credit courses ^[15].

5. Conclusion:

In short, as a new teaching mode, cross-school credit mixed teaching can not only point out the direction of curriculum teaching reform, fully mobilize students' enthusiasm for independent learning, but also guide students to explore professional knowledge through reasonable assignment of learning tasks, to improve their learning quality. In this regard, teachers should combine the actual situation of students and take effective measures to carry out cross-school credit mixed teaching, so as to better meet the learning needs of students, help them achieve sustainable development, and provide strong support for cultivating interdisciplinary talents with innovative ability and practical ability.

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References

- [1] Wang X, Li J, 2020, Research on the Innovation of Hybrid Flipped Teaching Mode of Cross-school Credit Courses from the Perspective of “Internet +”. *Journal of Hubei Institute of Adult Education*, 26(2): 54–62.
- [2] Cong Q, 2019, Cross-school Study Based on Educational Resource Sharing in Colleges and Universities. *Journal of Huaiyin Normal University (Natural Science Edition)*, 19(2): 167–169 + 177.
- [3] Jiang H, Yuan L, Li Z, et al., 2021, Practice of Hybrid Teaching Mode for College Students to Study Online and Take Credit Courses Across Schools. *Journal of Shenyang Agricultural University (Social Sciences Edition)*, 23(4): 486–490.
- [4] Huang Y, Yin N, 2022, Research on Teaching Effectiveness Improvement Strategies of Blended Teaching in Colleges and Universities: An Empirical Analysis Based on Inquiry Community Theory. *Science and Education Guide*, 2022(36): 22–28.
- [5] Xue M, 2019, Exploration and Reflection on the Mechanism of Cross-school Study and Credit Mutual Recognition. *Journal of Taiyuan City Vocational and Technical College*, 2019(6): 114–115.
- [6] Wei X, Cao J, Xiong F, 2020, Exploration on Mixed Teaching Mode of New Engineering Background. *Science and Education Guide (Next Ten-day Issue)*, 2020(33): 11–12.
- [7] Huang M, Liu H, Chen F, et al., 2021, Exploration and Practice of Hybrid Teaching Mode in Electromechanical Transmission and Control Course. *Internal Combustion Engine and Accessories*, 2021(2): 253–254.
- [8] Li L, Wu L, Zou X, et al., 2019, Exploration and Application of Flipped Classroom Teaching Model in the Teaching of “Mechanical Structure Design and Assembly”. *Southern Agricultural Machinery*, 51(13): 149–150 + 178.
- [9] He M, 2020, Research on Cross-school Study Teaching Mode of Online and Offline Hybrid Courses. *News Research Guide*, 13(18): 73–75.
- [10] Shen J, Wan Y, Wang X, et al., 2022, Cross-campus Data Backup Scheme of Fudan University. *China Education Network*, 2022(7): 71–73.
- [11] Gao F, Pan H, Wu F, 2022, Application of Flipped Classroom Teaching Method in Cross-school Credit Courses in Outline of Modern and Modern Chinese History. *Journal of Hubei Open Vocational College*, 35(11): 129–130.
- [12] Chang Z, Wu J, 2022, Exploration and Practice of Cross-school Credit Teaching Model of Automobile Construction Course. *China Modern Educational Equipment*, 2022(3): 130–132.
- [13] Cui G, 2022, Construction of Intelligent Network Learning Space in Colleges and Universities under Cross-school Teaching Mode. *Journal of Anshan Normal University*, 24(4): 59–62.
- [14] Chen Y, 2022, Learning Center Teaching: How to Understand Teaching Relationship and Teacher’s Leading Role. *Hubei Education (Education and Teaching)*, 2022(12): 34–36.
- [15] Huang Y, 2022, Research on Strategies to Promote College Students’ Learning Involvement in Blended Teaching, thesis, Guangxi Normal University.

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A Study on Employment Intentions and Employment Outcomes of Chinese Major Students at Souphanouvong University in Laos

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Abstract: Against the backdrop of building the China-Laos Community of Shared Future, the Chinese program at Souphanouvong University in Laos serves as a vital platform for cultivating bilingual talents, making the study of students' employment intentions and actual employment outcomes highly significant. This study, based on questionnaire surveys and interviews, provides an in-depth analysis of the employment preferences of current students and the career paths of the first cohort of graduates. It reveals a gap between market demands and educational offerings. The findings indicate that while students show strong interest in education, tourism, and trade sectors, they face challenges in career planning and practical skills. The first cohort of graduates has entered relatively concentrated employment fields, but some positions do not fully align with their expectations. To address these issues, the study proposes optimizing curriculum design, integrating teaching resources, and enhancing university-industry collaboration, aiming to provide references for the further development of the Chinese program at Souphanouvong University and offer insights for similar institutions in education reform and career guidance.

Keywords: Souphanouvong University; Chinese program; Employment intentions; Career paths; Talent cultivation

Online publication: April 28, 2025

1. Introduction

In the course of collaborative development between China and Laos, the Chinese language has become a crucial tool for promoting cultural exchanges, deepening mutual understanding, and building a community with a shared future between the peoples of China and Laos ^[1]. The Confucius Institute at Souphanouvong University was established in 2018 in the ancient northern capital of Luang Prabang, in partnership with Kunming University of Science and Technology. Since its inception, the institute has trained over 2,500 Chinese language learners, and the undergraduate Chinese program was approved for enrollment in 2020 ^[2]. The Chinese Department at Souphanouvong University currently has two full-time Chinese language instructors and primarily relies on

collaboration with the Confucius Institute at Souphanouvong University. Through mutual consultation, both parties jointly deliver the Chinese major courses ^[1]. The first cohort of 26 students graduated and entered the job market in September 2024. As of now, the program has 183 enrolled students. This paper utilizes questionnaires and interviews to investigate the employment intentions of current students and the employment outcomes of graduates from the Chinese major at Souphanouvong University. The findings aim to provide theoretical and practical support for optimizing the curriculum, enhancing students' employability, and guiding their career planning.

2. Research methodology

This study employs a combination of questionnaires and interviews. Prior to the official distribution of the questionnaire, a pilot test was conducted with three Chinese major students from Souphanouvong University (two current students and one graduate). After ensuring the reliability and validity of the instrument, the questionnaire was disseminated through online platforms and offline classrooms, accompanied by face-to-face interviews ^[3]. A total of 96 valid questionnaires were collected, and interviews were conducted with 10 graduates from the Chinese major at Souphanouvong University. The core research questions addressed in this study are:

- (1) What are the current employment intentions of Chinese major students at Souphanouvong University?
- (2) In which sectors are the initial graduates of the Chinese major at Souphanouvong University primarily employed? Do these employment outcomes align with market demands and student expectations?
- (3) What measures can be implemented to further enhance the teaching quality and employment competitiveness of Chinese major students at Souphanouvong University?

3. Survey results and analysis

3.1. Analysis of employment intentions of current students from the questionnaire survey

The survey results show that among the 96 respondents, 69 are willing to stay in Laos for employment, 24 wish to go to China, and 3 prefer to go to other countries. The main reasons for choosing to work in China include more job opportunities, family expectations, and the desire to further improve their Chinese language skills. The obstacles include visa issues, intense competition, pressure, and high study abroad costs. The main reasons for staying in Laos include family factors, the presence of many Chinese companies, and good development prospects. The obstacles are low salaries, few job opportunities, high living costs, and poor working conditions. Those who prefer to go to other countries cite family expectations, more job opportunities, and better salary and welfare benefits as their reasons.

The employment intentions after graduation, ranked by number of respondents, are as follows: translation, working in Chinese companies in Laos, business, international trade, entrepreneurship, Chinese language teaching, inheriting a family business, working in government institutions, working in embassies, staying at home without employment, and continuing further studies.

During the job selection process, students perceive their main disadvantages as lack of practical experience, weak translation and interpretation skills, insufficient professional knowledge, limited job information channels, weak social skills, and personality factors. The factors they consider when choosing a job, in order of importance, are personal interest, job alignment with their major, salary and benefits, career prospects, parental expectations, social status, work-life balance, personal relationships, policy support, and recommendations from friends.

Regarding ideal salary expectations, the respondents have relatively high expectations: 4 expect 2–3 million

kip, 2 expect 3–4 million kip, 10 expect 4–5 million kip, 36 expect 5–7 million kip, and 44 expect more than 7 million kip. Among them, 8 expect between 10 million and 15 million kip, and 2 expect salaries above 9 million kip or over 20 million kip. Additionally, 44 respondents have internship experience, with positions including translation, waiter, teacher, and sales. In terms of future career planning, 31 respondents have clear plans (mainly focusing on translation and business), 43 have a general direction, and 22 have no plans yet. If funding were available, 91.67% (88 people) of the students would choose to start their own business.

Students believe that learning Chinese is crucial for career development and personal growth. They suggest strengthening training in listening, speaking, writing, and grammar. They hope for more internship opportunities to apply Chinese in practical work and enhance their skills. Furthermore, students would like more interactive teaching in class, especially for those with weak foundations, and more support for them. Throughout the learning process, students generally believe that patience and persistence are key, and they recommend providing more extracurricular reading materials and online learning resources to help them better master the Chinese language.

3.2. Analysis of graduate employment situation from interviews

Among the 10 graduates from the first cohort of the Chinese major at Souphanouvong University who participated in the survey, 4 are working in translation, with 1 also teaching Chinese; 2 are full-time Chinese language teachers; 2 have chosen to work in Chinese companies in Laos; 1 has started a business in Laos; and 1 is working in the service industry, such as restaurants and hotels.

Regarding the alignment of current jobs with expectations, 5 respondents stated their work meets expectations, 1 stated it exceeds expectations, 3 said it is average, and 1 felt it does not meet expectations. In terms of salary, 1 person earns 2–3 million kip, 1 person earns 3–4 million kip, 4 earn 5–6 million kip, 1 earns 6–7 million kip, and 3 earn over 7 million kip. In terms of salary satisfaction, 8 respondents felt it was average, 1 (earning over 7 million kip) was very satisfied, and 1 (earning 2–3 million kip) was very dissatisfied. As for expected salary, 6 respondents expect over 7 million kip, 1 expects over 10 million kip, 2 expect more than 15 million kip, and 1 expects 4–5 million kip.

The main issues faced by the respondents in their work include insufficient practical experience, weak oral translation skills in Chinese, and inadequate mastery of professional knowledge. To address these issues, the respondents said they would continue reading relevant books and pursue further education for a master's or doctoral degree when the opportunity arises. Finally, the respondents all expressed no regrets about choosing the Chinese major and encouraged current students to study Chinese diligently. They mentioned that the courses taken during their studies have been helpful for their current work, particularly the theoretical knowledge, and have provided some practical opportunities. However, they hope there could be more practical experiences.

4. Recommendations for Optimizing Curriculum and Employment Guidance

Currently, Chinese language and related programs in overseas universities are mainly concentrated in Southeast Asia and Africa. These studies cover various aspects, including the current situation of Chinese language teaching abroad, curriculum design, and strategies for program development^[4–6], Chinese learning motivation and cultural identity^[7,8], as well as teaching methods and effectiveness^[9,10]. Based on relevant research, this paper proposes recommendations for optimizing curriculum design and employment guidance.

4.1. Optimizing curriculum design

For undergraduate students majoring in Chinese, the goal is to cultivate local Chinese language teachers or high-level talents in language and cultural exchange and research. Therefore, the curriculum design needs to strengthen the study of Chinese language and culture courses, with teaching objectives focusing on cultivating basic skills in listening, speaking, reading, writing, and translation, improving Chinese cultural literacy, broadening the perspective on Sino-foreign cultural exchanges, and laying a foundation for becoming qualified local Chinese teachers or continuing further studies after graduation ^[4]. The survey results show that students generally believe that learning Chinese plays a significant role in future career development and personal growth. They suggest further strengthening training in listening, speaking, writing, and grammar.

In response, the Souphanouvong University Confucius Institute will offer intensive classes in listening, reading, and speaking (16:00–17:30) for students at all levels of the Chinese major in October 2024. These classes will be taught by three international Chinese language education volunteers from the Confucius Institute (hereinafter referred to as “Chinese Teachers from the Confucius Institute”). At the same time, beginner-level classes and HSK2 training classes (16:00–18:00) will be offered to students inside and outside the university, taught by two Chinese Teachers from the Confucius Institute (**Table 1**).

Table 1. October 2024 Class Schedule at Souphanouvong University Confucius Institute (Main Campus)

Course time	Monday	Tuesday	Wednesday	Thursday	Friday
Classes Offered	Listening	Reading	Speaking	Reading	Speaking
	Beginner Class	HSK2 Beginner Class	HSK2	Beginner Class	HSK2

In addition, according to the curriculum design, the interpretation courses for senior-year students are taught by local Lao teachers from the Confucius Institute. To strengthen the theoretical and professional aspects of the course, the interpretation classes for senior-year students in the second semester are now taught by Chinese teachers who have graduated from the Confucius Institute’s Lao language program.

4.2. Strengthening classroom interaction and integration of Chinese learning resources

Interpersonal interaction during the teaching process is a primary method for conducting learning activities and an important means of acquiring knowledge and skills ^[11]. The survey results show that students generally hope teachers will increase interaction in Chinese language teaching and offer more help to students with weak foundations, demonstrating greater patience. In response, in October this year, the Chinese Director personally attended classes in various departments and provided suggestions for improvement. Currently, the dispatched teachers have arrived, and they will continue to observe classes and provide guidance.

At the same time, students suggest providing more Chinese learning resources, such as extracurricular reading materials and online learning platforms, to support them in better mastering the Chinese language. Currently, Chinese digital resources include, but are not limited to, digital materials, digital textbooks, online courses, and digital applications, each of which can be further divided into subcategories ^[12]. For example, digital textbooks can be categorized into static media textbooks, multimedia textbooks, rich media textbooks, and intelligent textbooks ^[13].

According to statistics, there are currently 3,679 digital textbooks, of which 1,744 are developed in China, accounting for 47.40%; there are 485 MOOC courses, with 364 available on domestic platforms, accounting

for 75.05%; there are 4,865 micro-lesson resources, 404 teaching websites, and 334 apps, of which 22.46% are language-focused apps.^[12] In the classroom, teachers encourage students to use Chinese digital resources, such as “Chinese Language Alliance.” In December, a batch of Chinese books provided by the Ministry of Education’s Center for Language Exchange and Cooperation has arrived at the Souphanouvong University Confucius Institute, and teachers are currently organizing the materials.

4.3. Strengthening university-enterprise cooperation and internship practice

From a functional perspective, Confucius Institutes not only need to meet the demand for learning Chinese and Chinese culture abroad but also represent the country and serve national strategic interests. Therefore, they must fulfill the basic educational functions of an educational institution while also providing services that have both global and national public product attributes^[14]. Similar to Ethiopia, Chinese language teachers in Laos are at a disadvantage in terms of salary compared to those working in Chinese-funded enterprises. Even if the academic qualifications are met, students tend to choose to work in Chinese-funded enterprises^[15].

The survey results show that students generally expect to apply their Chinese language skills to real-world scenarios through more practical work opportunities or internships to improve their professional abilities. To meet this demand, in 2023, the Souphanouvong University Confucius Institute organized a “Chinese + Vocational Education” university-enterprise cooperation forum during the northern Laos Talent Recruitment Fair. Representatives from various enterprises expressed their recruitment needs, and the institute designed targeted teaching programs based on these demands, signing talent cultivation contracts. The Confucius Institute, in collaboration with professional colleges, has launched Chinese language reinforcement courses, training talents with “Chinese + vocational skills” to support the economic and social development of northern Laos.

To promote internships and employment, the Confucius Institute issued the “Notice on Internship and Employment Opportunities for Outstanding Chinese Major Graduates” in 2024. The notice plans to arrange internships for senior-year students at relevant institutions from February to April 2025, encouraging students to establish employment intentions during their internships. Students who meet the job requirements can sign employment agreements with employers, enabling direct employment after graduation and aligning with social needs. In addition, in writing and comprehensive courses, Chinese teachers from the Confucius Institute guide third- and fourth-year students in creating personal resumes. The resumes of fourth-year students are collected and archived by the Confucius Institute’s academic office for use in the students’ job search process.

5. Conclusion

This study, through surveys and interviews, provides an in-depth analysis of the employment intentions of current students in the Chinese major at Souphanouvong University and the employment outcomes of its graduates. It explores the relationship between the job market demands and the educational offerings of the university. Based on the research findings, recommendations are made to optimize the curriculum, enhance classroom interaction and the integration of Chinese learning resources, and promote university-enterprise cooperation and internship practices. These measures aim to improve students’ employability, career planning, and overall competence. It is hoped that this study will provide valuable theoretical support for the development of the Chinese major at Souphanouvong University and offer reference points for course reforms and career guidance at similar institutions.

Disclosure statement

The author declares no conflict of interest.

References

- [1] Li B, Pan Y, 2022, The Current Situation, Challenges, and Development Strategies of Chinese Education in Laos. *Journal of Yunnan Normal University (Foreign Chinese Language Teaching and Research Edition)*, 20(3): 54–62.
- [2] Zhang M, Zhao S, 2022, The Current Situation, Trends, and Issues of Chinese Education in Laos. *Sinology and International Chinese Education*, 2022(1): 88–94.
- [3] Meng W, 2022, Survey and Analysis of the Employment Situation of Tajikistan’s Chinese Language Learners, thesis, Beijing Foreign Studies University.
- [4] Luo X, 2023, A Study on the Curriculum System of the Confucius Institute in Ethiopia. *Journal of Tianjin Vocational and Technical Normal University*, 33(3): 61–66 + 72.
- [5] Gao L, 2023, Research on the Construction of the Cultural Curriculum System for Chinese Undergraduate Majors in Ethiopian Universities Under the New Situation: A Case Study of Addis Ababa University’s Chinese Department. *Silk Road*, 2023(4): 108–114.
- [6] Pan J, Zhao Z, 2023, Research and Practice on the Chinese Major at Burundi University Under the “Belt and Road” Initiative. *Journal of Jiamusi Vocational College*, 39(10): 158–160.
- [7] Chen H, 2018, A Study on the Chinese Learning Motivation and Cultural Identity of South African Chinese Major Students, thesis, Jinan University.
- [8] Qiao L, 2019, A Survey on the Learning Motivation of Chinese Learners in Ghana, thesis, Shandong University.
- [9] Li Y, 2018, A Study on Task-Based Teaching in Intermediate Writing Courses for Chinese Majors in Thailand, thesis, Tianjin Normal University.
- [10] Sha Y, 2018, An Empirical Study on the Reverse Effect of the New HSK Level 3 on Romanian Chinese Major Students, thesis, Chongqing University.
- [11] Huang C, Xu Y, Wang X, et al., 2023, Cognitive Mechanisms of Knowledge Construction Through Interpersonal Interaction in Teaching From the Perspective of Multidisciplinary Integration. *Modern Educational Technology*, 33(12): 14–25.
- [12] Ma J, Liang Y, Wu Y, et al., 2021, 70 Years of International Chinese Education and Teaching Resource Development: Achievements and Prospects. *Journal of Tianjin Normal University (Social Science Edition)*, 2021(6): 15–22.
- [13] Hu P, Wang D, Xu J, et al., 2014, Characteristics and Functional Model of Digital Teaching Materials. *Modern Distance Education Research*, 2014(2): 120–125.
- [14] Ning J, Wang H, 2009, Analysis of the Public Product Attributes of International Chinese Promotion. *Dongyue Luncong*, 30(5): 176–180.
- [15] Zhou D, Wu Y, 2022, Survey and Research on the Development of Chinese Education in Ethiopia. *Language Education*, 10(3): 112–124.

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Application and Practice of “Learning-Practice-Innovation” Integrated Teaching Model in Civil Engineering Drawing

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Abstract: In the course of civil engineering drawing, an integrated “Learning-practice-innovation” teaching approach has been adopted. This method aims to enhance students’ grasp of professional knowledge and their ability to apply it comprehensively by merging theoretical study (learning), hands-on practice (Practice), and innovative application (innovation). This paper thoroughly examines this approach through course design, teaching implementation, case studies, and evaluation of teaching outcomes. Research findings indicate that the “learning-practice-innovation” model effectively overcomes the traditional teaching limitations, which often separate theory from practical application. It significantly boosts students’ drafting skills, fosters innovative thinking, and strengthens teamwork awareness. During instruction, students are encouraged to synthesize knowledge via representative case studies and creative projects. By employing a variety of teaching methods and assessment criteria, the positive impact of this model on student learning outcomes is well-documented. Based on the analysis of teaching practices, this paper offers several recommendations for future teaching reforms. It also explores potential development areas, including the integration of emerging technologies, cross-regional comparative studies, and other relevant aspects.

Keywords: Learning-practice-innovation integrated teaching model; Civil engineering drawing; Practical teaching; Innovation ability

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1. Introduction

With the swift advancement of the civil engineering sector, there is an increasing emphasis on enhancing both the professional skills and innovative capabilities of talents. Nevertheless, traditional civil engineering drawing instruction tends to concentrate heavily on theoretical knowledge, with students primarily adopting a passive reception approach. Consequently, practical training and opportunities for innovative exploration have been somewhat neglected^[1]. As educational philosophies evolve and new engineering paradigms emerge, fostering students’ all-around abilities in civil engineering drawing has become a pressing challenge for higher education

institutions seeking to reform and enhance their teaching practices. In response to this need, the integrated “learning-practice-innovation” teaching model has emerged. By reinforcing theoretical foundations through “learning,” intensifying practical skills via “practice,” and encouraging innovation during “innovative,” this model seamlessly integrates students’ acquisition of knowledge, practical proficiency, and independent innovation^[2]. It seeks to bridge the gap between theory and practice that often exists in conventional teaching methods, offering students a multifaceted learning experience and enabling them to develop their comprehensive qualities through real or simulated engineering projects^[3]. This paper focuses on the civil engineering drawing course and examines the application and impact of the “learning-practice-innovation” integrated teaching model. Specifically, it explores how this model influences teaching content design, implementation processes, and evaluation of teaching effectiveness. The findings from this research can serve as valuable references for educational reforms in universities and related institutions, while also providing insights for further refining this teaching approach.

2. Teaching design

2.1. Course objectives and content arrangement

Guided by the integrated “learning-practice-innovation” teaching model, this course aims to assist students in comprehensively acquiring the foundational theories and standard requirements of civil engineering drawing. It seeks to develop robust drafting skills while fostering innovation awareness and teamwork abilities during practical operations^[4]. The course design emphasizes not only knowledge transmission but also enhances students’ practical capabilities and overall innovative thinking to meet the demand for multidisciplinary talents in the modern civil engineering sector^[5]. Specifically, regarding knowledge objectives, students are expected to gain proficiency in the fundamental principles of engineering drawing, the utilization of drafting tools, and adherence to relevant standards and regulations. At the skill level, through a range of hands-on projects and collaborative activities, students will learn various engineering drawing techniques and be capable of completing drafting tasks for common civil engineering components and structures using both software and traditional manual methods^[6]. In terms of innovation goals, students are encouraged to engage in creative project design, presentation, and discussion. This process promotes critical thinking and exploration of novel drawing concepts, continuously broadening and deepening the application scope of civil engineering drawing.

In accordance with the aforementioned objectives, the course content is structured around three primary stages: “learning,” “practice,” and “innovation.” During the “learning” phase, fundamental civil engineering concepts such as plans, sections, and structural detail drawings are introduced. Case studies are employed to assist students in grasping key drawing principles and addressing typical challenges. In the “practice” stage, students engage in a range of project-based exercises and group discussions, enabling them to practice using drawing software or creating hand-drawn designs independently. This reinforces their foundational knowledge and enhances their practical skills. Finally, in the “innovation” stage, open-ended or simulated comprehensive drawing assignments are presented. Students are motivated to redesign and refine engineering drawings by integrating real-world engineering contexts or selecting their cases. This provides an opportunity for students to showcase and exchange ideas, further inspiring their innovative capabilities and fostering their proficiency in applying learned concepts holistically^[7].

2.2. “Learning-practice-innovation” integrated teaching concept and design framework

The “learning-practice-innovation” integrated teaching philosophy underscores the seamless fusion of theoretical

study (learning), hands-on practice (practice), and innovative application (innovation) to foster a positive feedback loop in knowledge and skills development. In civil engineering drawing instruction, students must not only grasp the principles and standards of drafting but also gain experience through practical exercises. This process should further encourage their independent innovation capabilities and potential^[8]. The essence of this approach is to move away from the traditional one-way teaching model where teachers lecture and students passively listen. Instead, it promotes an environment that is dynamic, interactive, and inquiry-based, allowing students to learn and develop more effectively.

The “learning” module emphasizes the acquisition of theoretical foundations and essential knowledge. By utilizing classroom instruction, case studies, demonstrations, and other methods, it aims to assist students in comprehensively understanding drawing standards, techniques, and design principles. Additionally, to reinforce learning outcomes, thought-provoking questions and group discussions are frequently incorporated, facilitating students’ grasp and application of key concepts through interactive engagement.

The “practice” section focuses on practical application and skill enhancement. Instructors typically create a series of hands-on projects, group experiments, or assignment tasks that require students to use drawing software or manually sketch designs. Throughout this process, students refine their drawing techniques as they engage in these activities. This segment not only evaluates students’ understanding of fundamental concepts but also fosters their teamwork and practical problem-solving skills to some extent.

The “innovation” section transitions students from “doing” to “thinking,” integrating real or simulated engineering contexts to inspire them to generate novel ideas and solutions. This segment also involves engaging in creative design improvements and explorations of specific structures and components. Here, students are required to apply their accumulated knowledge comprehensively, fostering deeper reflection and independent judgment. Instructors facilitate the merging of theoretical knowledge with innovative thinking by guiding discussions, providing feedback, and evaluating student projects. By systematically applying the teaching philosophy of “learning-practice-innovation,” the framework of the civil engineering drawing course better aligns with students’ cognitive development and professional growth requirements, achieving a harmonious integration of theory and practice, as well as knowledge and innovation.

3. Teaching implementation and case analysis

3.1. “Learning” link: theoretical knowledge and teaching methods

Using the teaching content of building construction engineering drawing as a case study, the “learning” phase primarily emphasizes students’ comprehension of the fundamental concepts and theoretical knowledge related to building construction engineering drawing^[9]. Initially, in alignment with the course objectives, the instructor identifies key knowledge points, such as the categorization of building engineering drawings, standard drawing norms and practices, critical aspects of building construction, and the principles for interpreting and creating plan, elevation, and section drawings^[10]. By means of classroom instruction, example presentations, and multimedia illustrations, students gain an initial understanding of the significance and practical applications of housing construction engineering drawings within the civil engineering domain.

To deepen students’ comprehension of the concept, Teachers can adopt the methods of situational introduction and heuristic questioning, such as presenting actual housing blueprints or photographs, to encourage students to contemplate the role that engineering drawings play in project execution^[11]. During this phase, teachers can dissect the functions and features of each view by referencing typical examples, like a full set of

floor, elevation, and section views for a residential building, while also addressing common errors and key identification points. To maintain classroom interaction, the teacher may facilitate group discussions or allow students to attempt a preliminary analysis of the engineering drawing, thereby reinforcing their theoretical understanding of architectural engineering drawings. Throughout this process, educators can leverage online teaching platforms or specialized software (such as BIM-related tools) to assist in visually demonstrating building structures and engineering drawing components. With the aid of interactive teaching resources, students can more clearly observe house layouts, structural nodes, and material compositions, fostering a deeper and more holistic understanding while establishing a robust theoretical basis for subsequent practical applications.

3.2. “Practice” link: practical training and skill improvement

The “practice” section is designed to enable students to apply the theoretical knowledge acquired in the earlier stages to real-world drawing and comprehension tasks. To achieve this, instructors will assign hands-on projects related to construction drawings of buildings. These projects may include creating the foundational plan, elevation, section, and key detail drawings for a two- or three-story residence. Students must complete the entire process—from initial conceptualization to the final drawings—based on the provided design specifications or real-world scenarios, while adhering to the standards and guidelines they have studied.

In the practical application, instructors can organize students into multiple teams, assigning each team a distinct section of a building construction blueprint. This approach aims to foster students’ collaborative skills and teamwork ^[12]. To maintain the standard of practical work, periodic evaluations can be scheduled, including preliminary draft reviews, mid-term discussions, and final submissions. During these evaluations, instructors should emphasize the accurate application of drafting symbols, notation techniques, and key aspects of building construction by the students.

3.3. “Innovation” link: comprehensive innovation and achievement display

The emphasis of “innovation” lies in encouraging students to engage in more profound design thinking and creative activities after acquiring drawing techniques and foundational knowledge of building construction. Educators may introduce open-ended projects, for instance, “Creating an energy-efficient and eco-friendly home suited for cold climates” or “Innovative remodeling of a compact rural residence with local features.” This allows students to perform integrative design work centered on both practical application and originality ^[13].

During this process, learners are required to consolidate their acquired knowledge, such as building structure, lighting and ventilation systems, thermal insulation techniques, energy efficiency strategies, and the use of sustainable materials. They should then apply this knowledge creatively based on specific contexts. For instance, when designing a residence in a cold region, students might focus on factors like the insulation wall’s thickness, window orientation, and envelope material choices. In the case of small rural homes, they could incorporate local architectural features while ensuring fundamental living requirements are met. By engaging in repeated evaluation and dialogue, students can enhance both their innovative thinking and overall design capabilities.

4. Teaching effect and discussion

By conducting a thorough evaluation of students’ test scores, classroom participation, and the quality of their assignments through multiple dimensions, the learning outcomes under the “learning-practice-innovation”

integrated teaching model can be more fully demonstrated. In theoretical assessments related to construction engineering drawings, most students have shown enhanced understanding of fundamental concepts and are now capable of proficiently interpreting and analyzing standard architectural blueprints. Practical work evaluations indicate significant improvements in students' precision and adherence to drawing standards, compared to before the implementation of this model, issues such as labeling errors, omissions, and unreasonable structural designs have been markedly reduced. Additionally, both the overall pass rate and excellence rate in homework submissions have improved. These objective metrics confirm the effectiveness of the "learning-practice-innovation" approach in facilitating students' internalization of knowledge and mastery of practical skills. In practical and innovative design projects, students increasingly focus on integrating elements like environmental protection, energy efficiency, regional characteristics, and spatial aesthetics into their architectural engineering designs^[14]. For instance, when designing a two-story house, some students incorporated strategies such as green roofing systems or sustainable materials to enhance the project's ecological sustainability. Through the presentation and defense of their creations, students exhibited strong proactive learning abilities and creativity, demonstrating proficiency in applying existing knowledge to address open-ended and complex drawing challenges. Furthermore, questionnaire and interview results reveal that the "innovation" phase heightens students' interest in specialized learning and fosters their critical thinking and innovative awareness^[15].

During the execution of teaching, educators commonly agree that the "learning-practice-innovation" approach can significantly bridge the gap between theoretical concepts and practical application. Additionally, students' ability to grasp and utilize knowledge efficiently within a limited timeframe has seen marked improvement. Some instructors further emphasize the importance of organizing the teaching schedule appropriately while maintaining an adequate level of practical depth, in order to prevent practical assignments from becoming overly scattered or complex. Student feedback indicates that they find activities like group collaboration and innovative design more engaging, which enhances their sense of involvement and accomplishment throughout the course. Nevertheless, a few students mentioned feeling "bewildered" at the onset of projects and suggested that additional guidance or illustrative examples would help them adapt more swiftly.

5. Conclusion and prospect

Based on the "learning-practice-innovation" model, ongoing enhancements and refinements are necessary to meet a wider range of teaching requirements. Firstly, it is recommended to enhance both teaching resources and the management framework. This can be achieved by adjusting the complexity levels of practical tasks, boosting investment in graphical software and hardware, and offering students additional hands-on training sessions along with access to open lab facilities. Secondly, emphasis should be placed on teacher development and collaborative efforts, ensuring that educators maintain coherence and forward-thinking strategies in designing projects, organizing instruction, and guiding students. This will effectively support students in engaging more actively with various educational activities.

Future research could explore two primary avenues. First, there is an opportunity to more extensively integrate advanced technologies like BIM and VR/AR into the "learning-practice-innovation" educational framework. This integration would provide students with a more immersive and intuitive experience in drawing and design. Second, we can broaden the scope of collecting teaching effectiveness data, enabling cross-regional and cross-disciplinary comparative studies with other institutions. This approach would help assess and enhance the adaptability and applicability of this model. By continuously refining teaching strategies and research

methodologies, the “learning-do-creation” integrated model is anticipated to offer greater value and impact in civil engineering drawing and other engineering courses.

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References

- [1] Li X, Fu L, Li F, et al., 2021, Teaching Reform and Innovation of Landscape Design Under the Background of Applied Talents. *Anhui Agricultural Sciences*, 27(20): 173–175.
- [2] Wu F, Yu X, Yin Y, et al., 2022, Exploration and Practice of Ideological and Political Education in Civil Engineering Curriculum. *Higher Education of Architecture*, 31(4): 115–121.
- [3] Li X, 2021, Practice Analysis of Civil Engineering Brand Specialty Construction in Local Applied Colleges and Universities. *University Education*, 2021(11): 24–25.
- [4] Savery JR, 2015, Overview of Problem-Based Learning: Definitions and Distinctions. *Essential Readings in Problem-Based Learning: Exploring and Extending the Legacy of Howard S. Barrows*, 9(2): 5–15.
- [5] Zhang L, 2020, Research on BIM Technology Integration in Course Teaching of Civil Engineering Major. *Journal of Civil Engineering*, 33(5): 78–82.
- [6] Wang M, Liu T, Li H, 2019, Research on Teaching Reform of Civil Engineering Drawing Course Based on Innovation Ability Cultivation. *Higher Education Research*, 28(4): 123–125.
- [7] Brown P, Adler RP, 2008, Minds on Fire: Open Education, the Long Tail, and Learning 2.0. *Educause Review*, 43(1): 16–32.
- [8] Lin H, Li W, 2020, Research on Innovation of Civil Engineering Curriculum Teaching Model Under the Background of New Engineering. *Engineering Education Research*, 11(3): 45–48.
- [9] Zhou Q, 2018, Discussion on Course Reform of Civil Engineering Drawing Based on Project-Based Learning. *Vocational Education Research*, 34(2): 58–60.
- [10] Smith KA, Sheppard SD, Johnson DW, et al., 2005, Pedagogies of Engagement: Classroom-Based Practices. *Journal of Engineering Education*, 94(1): 87–101.
- [11] Hu X, Chen H, 2021, Multi-Dimensional Teaching Reform and Practice of Civil Engineering Construction Technology Course. *Construction Technology Research*, 25(4): 89–92.
- [12] Tongji University, Xi'an University of Architecture and Technology, Southeast University, et al., 2016, *Building Architecture*, China Architecture & Building Press, Beijing.

- [13] Luo D, Zhang Z, Pan Y, et al., 2020, Exploration of the Teaching Mode of Engineering Courses Combined with MOOC and Project-Based Teaching. *Higher Engineering Education Research*, 2020(2): 164–168.
- [14] Chadwick SM, 2004, Curriculum Development in Orthodontic Specialist Registrar Training: Can Orthodontics Achieve Constructive Alignment? *Journal of Orthodontics*, 31(3): 267–274.
- [15] Peng H, Zhu T, 2021, Research on Mode and Path of Deep Integration of Specialized Innovation Under the Background of “Double First-Class” Construction. *Higher Engineering Education Research*, 2021(1): 169–175.

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Research on Transformation Path of Teacher Education Model and Construction of New Ecology under AI Empowerment

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Abstract: Under the background of the wide application of AI technology, the field of education has ushered in a profound change, which has renewed teachers' quality and teacher education model has innovated. Exploring the integration and development of artificial intelligence technology and teacher education has become an important educational topic. This paper puts forward a new idea of reforming the teacher education model based on AI technology, promoting the development of teacher education in the direction of science and fun, and analyzes the construction strategy of AI-based education ecology, so as to provide reference for promoting the integration of AI and college teacher education and building a new education ecology.

Keywords: AI; Universities and colleges; Teacher education model; Education ecology

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1. Introduction

In today's rapid development of artificial intelligence technology, facing the 2.0 era of integrated innovation and intelligent leadership, how to use new technologies such as artificial intelligence, big data and cloud computing to reconstruct the teaching mode of colleges and universities, create a new teaching ecology, update the teacher education mode, create a new type of education team, and promote the development of modern education has become a new topic for teachers to think about. According to the existing literature, artificial intelligence technology plays a more obvious and positive role in the field of education than traditional teaching methods^[1]. Therefore, artificial intelligence will become the educational technology with the greatest development potential after computer networks and multimedia. In this paper, the reform of the teacher education model and the construction of teaching ecology in the era of artificial intelligence are discussed in depth.

2. The concept connotation of artificial intelligence technology

2.1. Concept of artificial intelligence technology

Artificial Intelligence, also known as “AI.” The term was first coined in 1956 at the Dartmouth Six Weeks Conference, which defined artificial intelligence as “a machine whose learning or intelligence properties can be accurately described.” It can be seen that artificial intelligence technology is an emerging science and technology that simulates, expands and extends human intelligence. As an emerging research direction, artificial intelligence aims to understand the nature of intelligence and create new intelligent machines with intelligent behaviors similar to human beings ^[2]. Since its emergence, it has set off an upsurge of discussion in the scientific and educational circles. Today, with the continuous deepening of the research on artificial intelligence, its theory and technology are becoming more mature, and the scope of application is gradually expanding. The application of new technologies such as artificial intelligence, big data and cloud computing into the field of education can help colleges and universities establish effective and interactive smart classrooms, and further combine science and technology with education and teaching ^[3].

2.2. The development of artificial intelligence technology in the field of education

By using AI technology, colleges and universities can build a complete teaching system to provide support and help for teacher education. For example, the easy to operate classroom recording tool built based on artificial intelligence technology records all the routine classroom teaching plans, which facilitates teaching and research reflection, and establishes and accumulates school-based resources; The classroom interaction tools built can make teacher-student interaction more efficient and deepen normal university students’ understanding of education ^[4]. The digital teaching platform based on artificial intelligence technology helps teachers to break the “cramming” teaching method, improve the participation of normal students in class, and make classroom teaching more interesting. At the same time, the platform also enables teachers to have a timely understanding of the teaching situation in the classroom and make timely adjustments to the course content. Using the function of big data collection and analysis, teachers can also carry out accurate guidance and teaching management for normal students, implement the concept of teaching according to their aptitude, and provide personalized teaching for normal students. Intelligent analysis tools also provide scientific support for schools’ teaching evaluation and management decisions. Through the service mode of “cloud + network + terminal,” the information environment of the classroom is configured, and various terminal devices in the classroom are seamlessly linked and used intelligently, thus creating a learning environment full of wisdom ^[5]. In short, the in-depth application of artificial intelligence technology will bring a “revolutionary” impact on traditional teaching and will inevitably impact teacher education. It is the only feasible path for colleges and universities to actively face the basis and challenges brought by artificial intelligence.

3. The transformation path of teacher education mode under AI empowerment

3.1. Personalized and customized teacher education programs

Artificial intelligence technology has promoted the development of precision teaching and the development of teacher education in the direction of precision. In the training of normal talents, colleges and universities can collect and analyze students’ learning data, sort out learning characteristics, learning efficiency, learning preferences, etc., connect with the new requirements of teachers’ literacy in the education field of the intelligent era, formulate more accurate training programs, and match personalized education programs for different

students. At the same time, teachers can provide precise intervention and help according to students' learning needs. The intelligent platform records students' learning data, obtains data from various dimensions such as independent learning, classroom performance, and learning state, analyzes the potential characteristics and rules of their learning behaviors, and judges whether students have achieved their training goals ^[6]. Based on the learning information analyzed by big data, teachers can also check students' attendance, study time, test scores, etc., which can also help realize the precision of teaching management. Based on the information obtained from the analysis, teachers can conduct "one-to-one" guidance more efficiently, and urge students to complete online homework and check online learning resources promptly. The big data platform can also intelligently generate learning reports, analyze the professional knowledge and skill level of teachers, and provide directions for the subsequent optimization of training programs. The new generation of learners growing up in the background of artificial intelligence are eager to adopt a self-paced learning style anytime, anywhere, and artificial intelligence can obtain students' learning behavior data through big data to provide students with appropriate learning resources and learning environment. At the same time, it can promote the transformation of students' emotions and cognition and cope with learning with a positive attitude ^[7].

3.2. Precise delivery of education and training content

By automatically analyzing the learning behaviors of normal students, AI intelligently deduces the learning needs of students, and then pushes relevant education and training content for normal students and in-service training teachers. This precise push is not limited to course materials and videos, but can also include personalized learning suggestions, targeted practice questions, and the latest educational ideas and practice cases. With the push of the AI system, normal students and teachers can have access to richer learning resources that are more suitable for them. Colleges and universities can build intelligent educational resource libraries to automatically screen and recommend suitable learning materials based on students' professional direction, learning progress, and learning interests. In addition, AI technology can identify students' learning difficulties and weak links, provide timely counseling and remedial measures, and ensure that students fully master knowledge and skills. This kind of precise push can greatly improve the learning efficiency and effect of students, but also reduce the burden of teachers, so that they can focus more on teaching and research ^[8].

3.3. Intelligent long-term companion learning

AI technology can intelligently accompany normal university students and teachers to learn and participate in training. The AI system can automatically generate a record of the lecture, which is convenient for the subsequent review of normal students, can carry out key marks, mark out the important and difficult contents, and form a set of wrong questions, which can be retrained by normal students at the end of the semester or after the training. Normal students can make learning plans, and the AI system can automatically manage the learning plans, follow up on the learning progress of normal students, and remind them. This kind of intelligent long-term study companion enables students to manage their study plans more accurately and efficiently, and at the same time, they can find and solve problems in learning in time, improving students' learning quality and satisfaction. At the same time, the intelligent companion learning system can also provide teachers with students' learning dynamics and feedback, helping them better understand the students' learning situation, to formulate more effective teaching strategies. AI also helps teachers change their roles. Some "mechanical" work, such as traditional lesson preparation, homework correction, and after-class question-answering, can be completed by intelligent auxiliary systems, thus helping teachers to devote more energy to innovative and inspiring teaching, such as situational

interaction, development of creative thinking and personalized guidance^[9].

3.4. Intelligent analysis of training effects

Evaluation is an important part of teacher education, and the evaluation based on artificial intelligence can realize the whole process of evaluation, and carry out a comprehensive evaluation of the learning process of normal university students and the training results of in-service teachers. In the context of artificial intelligence, teachers should attach importance to the supervision and evaluation of teachers and the training process^[10]. Teachers can apply the monitoring and evaluation module in the AI system to monitor the learning process and training of normal university students and in-service teachers, to achieve better process management.

In terms of specific evaluation indicators, online discussion, reporting and speech ability, teamwork ability, organization and coordination ability, problem solving ability, innovation and entrepreneurship ability, logical thinking ability, professional ethics and other indicators can be integrated, so that the evaluation results not only reflect the students' understanding and mastery of educational theories and skills, but also make the evaluation results more comprehensive and accurate. Applying big data technology to carry out evaluation, teachers can make several data statistical charts to present students' learning data more clearly, objectively analyze whether students are up to standard in terms of academic performance, learning psychology, and habit formation, and combine target assessment with process assessment^[11]. Evaluation methods should also be diversified, and the number and frequency of evaluations should be appropriately increased in the teaching process by integrating student self-evaluation, mutual evaluation, and teacher evaluation. Assessment results can be applied to data mining, data visualization technology, and other means to carry out in-depth analysis and generate visual evaluation reports.

4. Education ecology in the context of AI

4.1. Forming a learning atmosphere where everything is connected

With the help of AI, the campus in the future is likely to become an intelligent and connected space. AI technology can make cold machines become a kind of interactive equipment that makes people feel warm. These intelligent machines will continue to learn human habits and summarize different teaching methods to help students learn more actively and more personally. AI technology is used to monitor the sound, smell, temperature and other parameters in the classroom, and automatically adjust the indoor air conditioning, lighting, ventilation equipment, etc., to effectively give play to the campus safety warning function, ensure that every system in the school can operate more efficiently and environmentally friendly, and create a comfortable and comfortable learning environment for students^[12]. In the "smart campus", the facial recognition of artificial intelligence can effectively improve work efficiency. Face recognition is a sign of an intelligent campus, which can provide a safer campus environment, provide more intelligent management for teaching, and help teachers understand the growth of students more comprehensively and systematically^[13].

4.2. Comprehensive development of students

In the new era, interdisciplinary talents with innovative consciousness and an open vision are needed. Based on AI technology, many tedious and repetitive tasks are being replaced by machines, which makes human personality more and more important in the future society, which also makes the future education further highlight the concept of "people-oriented", and pay attention to students and the generation of students' characteristics. This

makes the training of normal university students and in-service teacher training pay more attention to teachers' educational innovation ability and their ability to explore and cultivate students' characteristics. The famous German philosopher Jasper described education as shaking another tree with one tree, one cloud pushing another cloud, and one heart awakening another heart ^[14]. Therefore, a teacher is a combination of wisdom, emotion and creativity. In the future, the application of artificial intelligence in education, such as tutoring, online learning and classroom teaching, will continue to deepen, and students will be able to understand more diversified information and develop comprehensively under the promotion of artificial intelligence technology.

4.3. Continuous improvement of teachers' educational ability

With the help of artificial intelligence technology, teaching analysis and classroom management can be carried out intelligently, and teachers can spend more time studying teaching and educating people. The rapid update of artificial intelligence technology makes teachers increasingly feel a sense of crisis, and tedious teaching management and analysis work is being replaced by artificial intelligence technology. Under such a background, teachers must continuously improve their abilities, constantly adapt to the new teaching mode and teaching ecology created by new technology, and meet the new talent needs brought by social development ^[15].

5. Conclusion

The development of artificial intelligence has brought great changes to teacher education work, providing personalized, customized teacher education programs, accurate push of education and training content, intelligent long-term companion learning, intelligent analysis of training effects, and other functions. The training of normal students and teacher training should make good use of artificial intelligence, constantly improve the education and training methods, comprehensively mobilize the enthusiasm of normal students and in-service teachers to participate in learning and training activities, improve the quality of teaching and training, and help normal students and teachers grow up healthily and develop comprehensively. This paper discusses how to use artificial intelligence to build a new teacher education model and education ecology, and provides specific teaching strategies, hoping to contribute wisdom to the education of college teachers.

Disclosure statement

The author declares no conflict of interest.

References

- [1] Yang Y, Hu J, Ma J, et al., 2024, Exploring Educational Models for Training Postgraduate Students in Oral Medicine in the Era of Artificial Intelligence. *Journal of Clinical Stomatology*, 40(11): 686–688.
- [2] Liu BS, Wang YL, 2024, Challenges and Solutions for Reforming Vocational Education Models under Guided Pathways. *Journal of Jiangsu Vocational and Technical College of Economy and Trade*, 2024(4): 69–71 + 79.
- [3] Li D, Shao C, 2024, Research on the Reform of Vocational Education Models under the Reconstruction of Credit Banks in the Context of Digital Transformation. *Educational Observation*, 13(22): 8–10 + 32.
- [4] Yi S, Xu S, Li Q, 2024, Exploration on Teaching Reform of Polymer Material Molding and Processing Course Based on OBE-CDIO Education Model. *Chemical Engineering Management*, 2024(20): 32–35.

- [5] Shen WZ, 2024, Research on Ideological and Political Education Model and Strategy Reform From the Perspective of “Internet +”. *Journal of Hubei Open Vocational College*, 37(10): 106–108.
- [6] Deng J, Li F, 2024, Research on Printed Materials and Suitability Curriculum Reform Under Digital Education Model. *Paper Making Equipment and Materials*, 53(4): 173–175.
- [7] Xiao N, 2024, Reform and Practice of Blended Education Model of Front Office and Guest Room Management Courses Based on Superstar Learning Pass. *Modern Commerce Industry*, 45(8): 195–197.
- [8] Zhang YR, Ma J, Zhang Y, 2024, Research on Hybrid Education Model Reform Based on OBE Concept – Taking Logistics Technology and Equipment Course as an Example. *Modern Commerce and Trade Industry*, 45(6): 252–254.
- [9] Zhao J, 2024, Application of Research-Oriented and Teaching-Back Education Model to the Teaching Reform of Semiconductor Physics Course. *Physics and Engineering*, 34(1): 67–72.
- [10] Sun L, Liu Y, 2023, Blended Education Model: Reform and Innovation in Teaching Concepts. *Journal of Heilongjiang Teacher Development College*, 42(12): 46–49.
- [11] Qiu A, 2023, Strategies for the Reform of Secondary Vocational Accounting Education Model in the Era of Big Data. *Asia Pacific Education*, 2023(20): 185–188.
- [12] Zhu Y, 2023, Analysis of Higher Mathematics Teaching Reform Strategy Under Innovative Education Model. *Journal of Hubei Open Vocational College*, 36(18): 18–20.
- [13] Lu X, Luo Y, Yao Y, et al., 2023, Exploration on Teaching Reform of Fine Chemical Comprehensive Experiment Course Based on CDIO Engineering Education Model. *China Modern Educational Equipment*, 2023(17): 80–82.
- [14] Gao X, Peng S, Zheng X, et al., 2023, Research and Practice on the Path of Reform and Development of Blended Education Models. *Journal of Longdong University*, 34(5): 129–134.
- [15] Li T, 2023, Application of Internet Technology in Innovation and Development of Ideological and Political Education Model in Colleges and Universities – Review of the Reform and Development of Ideological and Political Education in Schools Under Network Environment. *Media*, 2023(17): 104.

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Research on Strategies for Improving College Students' English Writing Skills Based on Internet Online Corpora

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Abstract: This paper studies strategies for improving college students' English writing literacy based on online corpora on the Internet. Factors related to learners of English writing corpora include corpus sources, years of English learning, educational level, and major. Task factors include text types, writing time limits, and the use of reference books. The corpus consists of three subcorpora: General English, Business English, and Academic English, with a storage capacity of 3.256 million words. Its main uses include setting writing standards for science and engineering college students, constructing autonomous learning platforms, studying the characteristics of interlanguage phrases, conducting diachronic studies of interlanguage, and translation studies.

Keywords: Corpus; College students; English writing; Interlanguage

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1. Development background

The "College English Teaching Syllabus" (2020 Edition) (hereinafter referred to as the "Syllabus") points out that the goal of college English teaching is to cultivate students' English application abilities, and it proposes three levels of teaching objectives from the five aspects of English listening, speaking, reading, writing, and translation. The third-level goal for "written expression ability" requires: students can appropriately use writing skills. They can express their personal views in written English more freely; they can write expository and argumentative texts on a wide range of social and cultural topics with a certain depth of thought, clear expression, rich content, clear structure, and strong logic ^[1].

The "Syllabus" also points out that in the era of informatization and intelligence, multimedia technology and big data, virtual reality and artificial intelligence technology have become important means of foreign language education teaching. How to improve students' English writing ability has always been a focus in domestic English teaching, and the emergence of online corpora has provided a new path for English writing, especially in the use of vocabulary and the appropriateness and diversity of sentence expression ^[2].

A learner corpus refers to “an electronic collection of real learner language texts collected according to certain design specifications to improve foreign language teaching.” Over the past 30 years, corpus linguistics, with a large amount of real texts and powerful retrieval and statistical tools, has opened up new ways for language description and analysis ^[3]. Since the early 1990s, the rapid construction and in-depth development of learner corpora have greatly promoted research on learner language output based on corpora and have continuously changed the face of traditional second language acquisition and foreign language teaching research.

Due to cultural differences between China and the West and the negative transfer of the mother tongue, college students generally find it “very difficult” to write a decent English composition. In the college English four and six-level exams, the writing part scores are far below the passing line, which shows that the current English writing level of college students is low, and the writing situation is not optimistic ^[4]. The reasons are mainly that teachers and students do not pay enough attention to English writing courses, and there is too much listening and reading training in domestic college English teaching, with insufficient class hours for English writing instruction. Secondly, English writing teaching methods are outdated, and many teachers do not use the vast teaching resources on the Internet platform, English corpora, and other digital age teaching tools. Finally, students lack interest in English writing; English is a foreign language for college students, and they have not established a good English thinking habit and learning interest, and they lack autonomous learning ability.

2. The role of English writing corpora

The study has independently constructed standard model text corpora and student composition corpora using online corpus resources on the Internet. Through four aspects of vocabulary, vocabulary precision, phrase combination, and syntactic construction, the study has deeply analyzed the characteristics of college students’ English writing ^[5]. At the same time, the study has explored how to use corpora to compare the differences between student works and standard models, and accordingly carried out multi-angle quantitative analysis and qualitative evaluation of college students’ English compositions. Based on this, the study has summarized the common problems in college students’ English writing and put forward targeted suggestions for English writing teaching to improve students’ writing ability.

2.1. Corpus structural design

In building the corpus, the study follows the design criteria aimed at ensuring the accuracy and credibility of subsequent research, with the ultimate vision of “helping teachers optimize writing teaching and improve students’ writing skills” ^[6]. The design of the corpus focuses on three core elements. The first is the determination of the corpus style, which guides the subsequent corpus collection and structural design, and the study clearly positions the corpus as a collection of written texts. Second, the text selection process of the corpus is crucial, and the study carefully retrieves and organizes online resources on the Internet to select the latest, high-quality, and widely representative text materials to ensure the timeliness, comparability, and integration of the corpus. Finally, the data comparison and analysis functions of the corpus are indispensable, and the study deeply analyze the actual needs of teachers and students in English writing teaching, and accordingly clarify the type, scale, structure, and content of the corpus, and successfully establish a small-scale student composition corpus and standard model text corpus suitable for teaching, providing strong support for teaching ^[7].

2.2. Corpus data collection and organization

College students' real written texts constitute the data foundation of the student composition corpus, which includes at least 1000 works. The standard model text corpus widely collects a variety of resources such as excellent English writing at home and abroad, college English four and six-level exam full-score models, and original English writing materials published on the network platform, as a reference benchmark, and its sample size naturally exceeds the student composition corpus^[8]. The total sample size of the standard corpus integrated on the Internet platform is sufficient to meet this demand.

In the process of building the corpus, the study has adopted a variety of collection methods, such as online retrieval, voice entry, and scanning recognition technology. After collection, the study has carefully organized and preprocessed the texts, including correcting non-standard punctuation marks and adjusting paragraph formats, to ensure the accuracy and timeliness of subsequent vocabulary analysis, collocation statistics, and retrieval results^[9].

2.3. Corpus data statistics and analysis

The study uses corpus resources to compare the student composition corpus with the standard model text corpus, and deeply analyze the current situation and characteristics of college students' English writing from four aspects: vocabulary, vocabulary precision, phrase usage, and syntactic construction. The specific analysis includes the following aspects:

- (1) The similarities and differences in the number of high-frequency words and their usage frequency between the two corpora;
- (2) The sensitivity and precision of students' vocabulary selection in similar contexts;
- (3) Preferences and characteristics of phrase combinations in English writing practice, as well as the frequency of idiomatic usage;
- (4) The frequency and accuracy of complex syntactic structures in English writing;
- (5) An exploration of the correlation between the above four dimensions of data and the overall quality of student compositions.

3. Design principles

3.1. Overall planning

In foreign language teaching research, the specific effectiveness of learner corpora is deeply influenced by a series of controllable variables^[10]. These variables can be roughly divided into two categories: one is related to the learners themselves, covering learning environment, mother tongue background, and foreign language proficiency; the other is related to task execution, including task time limits, execution environment, and available reference materials.

3.2. Text types

The distinction of text types fundamentally answers the purpose of learning a language. As mentioned by previous studies, general English forms the foundation, and English for specific purposes (covering business English and academic English) is "an important direction for promoting our country's college English teaching to a higher level"^[11]. In addition, these three types of texts have significant differences in communication intentions, theme content, discourse structure, vocabulary, and grammar^[12].

4. Application Prospects

To meet this challenge, the study will select examples from domestic and foreign English teaching materials based on preset occupational scenarios to construct a model composition corpus, to assess the degree of fit or deviation of student compositions from model standards ^[13]. For tasks such as company and product introductions, the study will integrate text information from the official websites of well-known European and American companies with the model composition corpus to form an EOP reference corpus, that is, a business English writing corpus.

5. Conclusion

Collecting real writing texts from college students and online English resources to expand and establish a college English writing corpus can not only provide rich materials for college students' writing but also provide practical reference value for English writing teaching corpus research. At the same time, the capacity of the corpus can be increased with the continuous use in writing teaching, and its functions can be continuously improved based on the feedback from teachers and students, enhancing the quality and timeliness of the data in the corpus ^[14]. The expansion and application of the online corpus is the biggest innovation of this project.

Combining the actual situation of college English writing teaching, using the comparative research method of the corpus, combining teaching content with corpus tools, understanding the problems that students are prone to in writing through data collection and analysis, and improving teaching methods and teaching effects ^[15]. Students can cultivate autonomous learning ability and improve their writing literacy through comparative learning with the corpus.

In summary, the establishment and development of the English writing corpus for Chinese science and engineering students are of great significance for an in-depth understanding of the English writing ability of Chinese science and engineering college students. This corpus is not only a valuable resource but also is expected to play a core role in the field of educational technology.

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References

- [1] Al-Kharabsheh A, Hamadeh N, 2017, Shifts of Cohesion and Coherence in the Translation of Political Speeches.

Advances in Language and Literary Studies, 5: 26–28.

- [2] Behnam B, Yaghchi MA, 2019, The Impact of Formal Instruction of References and Conjunctions on Reading Comprehension of Iranian ESP Students. *Procedia – Social and Behavioral Sciences*, 9: 62–66.
- [3] Boas F, 1940, *Race, Language and Culture*. Macmillan, 1940: 1–237.
- [4] Chanyoo N, 2016, A Corpus-Based Study of Connectors and Thematic Progression in the Academic Writing of Thai EFL Students. *ProQuest LLC*, 15: 33–36.
- [5] Manning CD, Schütze H, 1999, *Foundations of Statistical Natural Language Processing*. MIT Press, USA.
- [6] Aston G, Burnard L, 1998, *The BNC Handbook*. Edinburgh University Press, 1998: 1–268.
- [7] Atkins S, Clear J, Ostler N, 1992, Corpus Design Criteria. *Literary and Linguistic Computing*, 11: 102–106.
- [8] Leech G, 1992, *Computers and Corpus Analysis*. *Computers and Written Texts*, 1992: 1–246.
- [9] Scott M, 2008, *WordSmith Tools Version 5*. *Lexical Analysis Software*, 2008: 1–276.
- [10] Mohammed, Sadiya A, 2015, Conjunctions as Cohesive Devices in the Writings of English as Second Language Learners. *Procedia – Social and Behavioral Sciences*, 5: 22–26.
- [11] Petersen U, 2004, Emdros – A Text Database Engine for Analyzed or Annotated Text. *International Conference on Computational Linguistics*, 2004: 1–253.
- [12] Ravid D, Berman RA, 2010, Developing Noun Phrase Complexity at School Age: A Text-embedded Cross-linguistic Analysis. *First Language*, 10: 98–101.
- [13] Read J, 2000, *Assessing Vocabulary*. Cambridge University Press, London.
- [14] Richards B, 1987, Type/Token Ratios: What Do They Really Tell Us? *Journal of Child Language*, 11: 88–90.
- [15] Vygotsky LS, 1978, *Mind and Society: The Development of Higher Psychological Processes*. Harvard University Press, Cambridge.

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Research on the Path of Integrating Literary Creation with Tourism Product Development Based on the Inheritance of Intangible Cultural Heritage

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Abstract: This paper focuses on integrating literary creation with tourism product development against the background of the inheritance of intangible cultural heritage. It analyzes the significance, current situation, and problems this integration faces. It deeply explores specific paths for integration from multiple aspects, such as digging into the cultural connotations of intangible cultural heritage, innovating forms of literary creation, creating diversified tourism products, strengthening cooperation and coordination, and expanding communication channels. The aim is to provide useful references for promoting the inheritance of intangible cultural heritage, enriching the cultural connotations of tourism products, and facilitating the high-quality development of the cultural tourism industry.

Keywords: Intangible cultural heritage; Literary creation; Tourism product development; Integration path

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1. Introduction

Intangible cultural heritage bears rich historical and cultural memories and regional characteristics and is a gem of human civilization. With the vigorous development of the tourism industry, how to better integrate intangible cultural heritage into tourism product development has become a focus in the field of cultural and tourism integration^[1]. Literary creation, as a cultural expression form with great appeal and communicative power, can build a bridge between intangible cultural heritage and tourism products, enabling a deep integration of the two. This helps with the inheritance and dissemination of intangible cultural heritage and enhances the cultural quality and attractiveness of tourism products. This paper aims to conduct in-depth research on the effective paths for integrating literary creation with tourism product development based on the inheritance of intangible cultural heritage to contribute to the coordinated development of the cultural tourism industry^[2].

2. Significance of integrating literary creation with tourism product development under the background of intangible cultural heritage inheritance

2.1. Assisting in the inheritance and dissemination of intangible cultural heritage

Literary creation can vividly display the historical origins, technical characteristics, and cultural connotations behind intangible cultural heritage through various forms such as stories, poems, and prose. For example, many works by Mr. Feng Jicai present the intangible cultural heritage elements of folk culture in Tianjin, making more people aware of and interested in these intangible cultural heritages. This expands the audience group of intangible cultural heritage, breaks the limitations of region and time in traditional inheritance, and enables it to be inherited and disseminated in a wider range.

2.2. Enriching the cultural connotations of tourism products

Traditional tourism products often focus on natural scenery or simple entertainment projects. After integrating elements of literary creation and combining them with intangible cultural heritage, tourism products can be infused with profound cultural deposits ^[3]. For instance, the tourism development of Phoenix Ancient City in western Hunan, relying on “Border Town” (written by Shen Congwen), makes the local folk customs and the love story of Cuicui in the book complement the local intangible cultural heritage of folk customs. Tourists can not only enjoy the beautiful scenery during the tour but also experience a unique cultural charm, enhancing the depth and quality of the tourism experience.

2.3. Promoting the coordinated development of the cultural tourism industry

The reading and aesthetic value of literary works will make readers, who are the main body of reading reception in the process of literary dissemination, “generate emotions from the text” and be inspired to have the impulse to travel to the places where the literary scenes are located ^[4]. Intangible cultural heritage plays an indispensable role in the field of literature and art ^[5]. Therefore, the integration of literary creation and intangible cultural heritage is conducive to integrating the resources of culture and tourism. It also protects and promotes the virtuous cycle of the entire cultural tourism industry chain, driving the prosperity and development of the local economy, culture and other aspects. While the cultural influence brought by literary creation attracts tourists, the consumption of intangible cultural heritage tourism products by tourists can, in turn, feed back to literary creation and intangible cultural heritage.

3. Current situation and problems of the integration of literary creation and tourism product development

3.1. Lack of awareness of integration

Some cultural tourism departments, tourism enterprises, and literary creators in certain regions lack the awareness of active integration and have not fully realized the important value of literary creation for the inheritance of intangible cultural heritage and tourism product development ^[6]. In the process of planning and developing tourism products, they fail to deeply tap into intangible cultural heritage resources and package and promote them through appropriate literary creation. As a result, many high-quality intangible cultural heritages remain hidden and tourism products lack unique cultural charm.

3.2. Lack of in-depth exploration

In some existing attempts at integration, the exploration of the cultural connotations of intangible cultural heritage is often superficial. Literary creation only briefly mentions the names or forms of intangible cultural heritage without truly integrating the spirit and the inheritance context of the skills contained in intangible cultural heritage. Tourism product development also mostly stays at the primary stage of displaying intangible cultural heritage objects and performing traditional skills, failing to enable tourists to deeply appreciate the essence of intangible cultural heritage and making it difficult to form lasting attractiveness.

3.3. Imperfect cooperative mechanism

There is a lack of effective communication and cooperation mechanisms among literary creators, intangible cultural heritage inheritors, and tourism developers. Creators are unaware of the needs of the tourism market and the key points of intangible cultural heritage inheritance. Intangible cultural heritage inheritors have difficulty transforming their skills into content that meets the requirements of tourism products. Tourism developers do not know how to use the power of literature to improve product quality. With each party acting independently, it is difficult to achieve high-quality integration.

3.4. Limited communication channels

Although there are some literary works involving intangible cultural heritage and related to tourism products, there are limitations in communication. There is no systematic and multi-channel promotion model. Relying solely on traditional publishing and distribution or a small amount of publicity within scenic areas, it is difficult to reach a wider audience. As a result, the integrated tourism products have low awareness and insufficient market influence.

4. Paths for integrating literary creation with tourism product development based on the inheritance of intangible cultural heritage

4.1. Dig deep into the cultural connotations of intangible cultural heritage to provide materials for literary creation

4.1.1. Conduct a comprehensive survey and research on intangible cultural heritage

Organize professional personnel to conduct a comprehensive and meticulous census of local intangible cultural heritage resources, and gain an in-depth understanding of the origin, development, technical characteristics, cultural implications and other aspects of each item of intangible cultural heritage. Through the documentary descriptions and re-creations of various intangible cultures, incorporate them into the scope of literary expression^[7]. For example, for the intangible cultural heritage project of traditional embroidery techniques, it is necessary to sort out the evolution of embroidery stitches, the symbolic meaning of patterns, and the differences in regional styles, providing a detailed and accurate material base for literary creation.

4.1.2. Extract the core elements of intangible cultural heritage

Extract representative and appealing core elements such as mythological legends, classic stories, and iconic symbols from the complex information of intangible cultural heritage^[8]. Taking paper-cutting, the intangible cultural heritage, as an example, the legend stories behind the paper-cutting patterns related to folk festivals and carrying good wishes can be selected, and integrate them into literary creation to create attractive stories, poems, etc., which

makes it easier for tourists to understand and remember the paper-cutting intangible cultural heritage project.

4.2. Innovate forms of literary creation to fit the characteristics of tourism products

4.2.1. Develop thematic literary works

Create novels, scripts, and other long-form works centered around the theme of intangible cultural heritage, setting up fascinating plots and vivid character images to make them highly readable and watchable. For example, create a historical novel with the background of the ceramic firing techniques in Jingdezhen, telling the inheritance stories of several generations of ceramic craftsmen and their emotional entanglements with porcelain. This can not only show the charm of ceramic firing techniques but also attract tourists to explore related tourism products in depth.

4.2.2. Create interactive literary content

Combined with modern technology, interactive literary experiences are created by utilizing technologies such as virtual reality (VR) and augmented reality (AR), along with a new model of “literary animation works + tourism,” which brings brand-new experiences to consumers ^[9]. For example, when tourists visit the intangible cultural heritage site of the ancient stage, they can read an interactive novel adapted from local opera stories by scanning the QR code with their mobile phones. Readers can choose the plot direction as if they were in the opera story themselves, enhancing tourists’ sense of participation and experience, and making literary creation better serve tourism products.

4.3. Create diversified tourism products and integrate elements of literary creation

4.3.1. Develop tourism products of cultural experience

Based on the intangible cultural heritage scenes depicted in literary works, immersive experiences of tourism projects are created by breaking through the traditional “viewing mode” ^[10]. For example, according to the display of intangible cultural heritage elements such as traditional clothing, diet, and etiquette in “A Dream of Red Mansions,” create a “Dreaming Back to the Red Mansions” experience tour in relevant scenic areas. Let tourists personally participate in making Red Mansions-style food, trying on traditional clothing, and learning ancient etiquette. Through such experiential tourism products, deeply integrate literature, intangible cultural heritage, and tourism.

4.3.2. Design literary theme-based tourism routes

Design theme-based tourism routes with the regions mentioned in the works of famous writers that involve intangible cultural heritage. For example, the “Lu Xun’s Hometown Intangible Cultural Heritage Tour” route connects scenic spots related to Lu Xun’s works such as Baicao Garden and Sanwei Bookstore, as well as local intangible cultural heritage projects such as yellow rice wine brewing and Yue opera in Shaoxing. Tourists can follow the route to trace the footsteps of the literary master and experience the rich charm of intangible cultural heritage, enriching the diversity of tourism products.

4.4. Strengthen cooperation and coordination to gather the joint force for integrated development

4.4.1. Build a cooperation platform

Government departments and industry associations should take the lead in building an exchange and cooperation

platform among literary creators, intangible cultural heritage inheritors, and tourism developers, and regularly hold seminars, project matchmaking meetings, and other activities. Through these platforms, all parties can share resources, exchange ideas, and jointly discuss how to better integrate literary creation with the development of intangible cultural heritage tourism products and promote the implementation of cooperation projects.

4.4.2. Cultivate cross-disciplinary talents

Universities and vocational colleges should set up relevant majors or courses to cultivate cross-disciplinary talents who understand literary creation, are familiar with intangible cultural heritage, and master the knowledge of tourism product development. For example, set up a compound major of “Intangible Cultural Heritage, Literature and Tourism,” build an art gallery, and take “passing on” as a way of “inheriting” to establish clubs with the characteristics of intangible cultural heritage ^[11]. Through theoretical learning and practical training, students can acquire the ability to integrate multiple resources for integrated development and continuously supply professional talents for the industry.

4.5. Expand communication channels to enhance the influence of integrated products

4.5.1. Utilize new media platforms

Take advantage of new media platforms such as WeChat official accounts, Douyin, and Xiaohongshu to release fragments of literary works related to intangible cultural heritage, introductions to tourism products in video form, and tourists’ experience sharing. Attract netizens’ attention through exquisite pictures and texts, interesting short videos, etc., and create internet-famous intangible cultural heritage tourism products ^[12]. For example, Douyin influencers can show the production process of handicrafts adapted from folk legend literary creations, attracting a large number of fans’ attention and thus increasing the popularity of related tourism products.

4.5.2. Carry out cultural festival activities

Hold cultural festival activities with the theme of intangible cultural heritage and integrating literary elements, such as the “Intangible Cultural Heritage and Literature Festival.” During the activities, hold literary work recitation meetings, intangible cultural heritage skill competitions, and the release of tourism routes of intangible cultural heritage theme based on literary works ^[13]. Invite the media to participate in the reporting to expand the influence of the activities, attract more tourists to participate, and spread the integrated tourism products in a wider range.

5. Conclusion

Culture is the soul of tourism, while tourism is the carrier of culture ^[14]. The creation of tourism literature has also promoted the prosperous development of the tourism industry to some extent ^[15]. Under the background of the inheritance of intangible cultural heritage, the integration of literary creation and tourism product development is of great significance and has broad prospects. The integration of culture and tourism can be effectively promoted through paths such as deeply digging into the cultural connotations of intangible cultural heritage, innovating forms of literary creation, creating diversified tourism products, strengthening cooperation and coordination, and expanding communication channels. It achieves a win-win situation for the inheritance of intangible cultural heritage and the development of tourism products, injects new vitality into the high-quality development of the cultural tourism industry, and enables intangible cultural heritage to shine more brightly in the new era with the

help of literature creation and tourism.

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References

- [1] Guo Y, 2024, Research on the Integration of Culture and Tourism to Promote the Creative Transformation and Innovative Development of Intangible Cultural Heritage. *Dahe Art Newspaper*, November 29.
- [2] Wang S, 2024, Regional Culture Empowers the Development of Tourism Products. *Cultural Industry*, 2024(24): 121–123.
- [3] Chen L, 2006, The Protection of Intangible Cultural Heritage from the Perspective of Folk Traditional Entertainment Culture. *Guizhou Ethnic Studies*, 26(3): 105–110.
- [4] Sun K, 2023, A Study on Guilin's Literary Tourism Resources in Liang Yusheng's "The Sword of Guangling," thesis, Guangxi Normal University.
- [5] Wei L, 2023, The Inheritance and Development of Literature and Art from the Perspective of Intangible Cultural Heritage. *Literature and Art Weekly*, 2023(21): 52–54.
- [6] Yang Y, Liu L, Tang Q, 2018, Research on the Development of Jia Pingwa's Literary Tourism from the Perspective of Experience Economy. *Liaoning Agricultural Sciences*, 2018(1): 20–23.
- [7] Liu Y, Xie C, 2020, A New Theory on the Creation of Tourism Literature Based on the Expansion of the Tourism Market. *Northern Economy and Trade*, 2020(12): 153–154.
- [8] Lu P, 2024, Innovative Paths for the Application of Folk Arts in Shandong Province in the Development of Tourism Products. *Love Art*, 2024(3): 122–125.
- [9] Shi H, 2022, Research on the Development and Design Paths of Xiamen's Cultural Tourism Animation Products. *Journal of Jimei University (Philosophy and Social Sciences Edition)*, 25(6): 87–92.
- [10] Liu L, Jiu Z, 2024, Development Paths for Immersive Tourism Experience Products of Intangible Cultural Heritage. *Cooperative Economy & Science*, 2024(14): 64–66.
- [11] Zhou S, 2014, On the Inheritance and Development of Local Intangible Cultural Heritage in Colleges and Universities. *Northern Music*, 2014(9): 11–19.
- [12] Tan H, Tan C, 2020, "Animation Creation Project": A New Path for the Protection and Inheritance of Folk Stories. *Journal of Original Ecological Ethnic Culture*, 12(6): 138–144.
- [13] Zhang W, 2015, Research on the Tourism Development Modes of Intangible Cultural Heritage. *Frontier Economy and Culture*, 2015(6): 34–37.
- [14] Xu Q, 2022, Research on the Paths and Modes of the Development of Cultural Tourism Products. *Tourism & Photography*, 2022(14): 72–74.
- [15] Li T, 2019, Tourism Literature and Its Application in Tourism Development. *Marketing*, 2019(35): 91–92.

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Pedagogical Practice of Integrating VLSI Design Automation Tools into University-Level IoT Curriculum

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Abstract: With the rapid advancement of Internet of Things (IoT) technologies, there is an urgent need for universities to explore more effective teaching models in IoT engineering programs, particularly to address shortcomings in hands-on training and the disconnect between theoretical instruction and industry demands. Very-Large-Scale Integration (VLSI) technology, as one of the core components of IoT, plays a critical role in determining the performance and market competitiveness of IoT devices. The integration of VLSI design automation tools not only improves design efficiency but also provides intuitive and effective means for practical teaching. This study centers on CMOS semiconductor devices and constructs a radial knowledge framework encompassing “Device–Model–Circuit–System.” By employing LTSPICE, a professional-grade simulation tool, the instructional content is visualized, enabling students to develop a deeper understanding of complex circuit principles and device characteristics. In addition, real industrial-grade SPICE models and fabrication process parameters—such as the 45 nm silicon-on-insulator (SOI) technology—are introduced to strengthen the link between academic instruction and practical engineering applications. Moreover, this research incorporates emerging technologies such as artificial intelligence, deep learning, and autonomous driving into instructional case studies, effectively enhancing student engagement, interest, and innovation capacity in practice-based learning environments.

Keywords: Very-Large-Scale Integration; Internet of Things Engineering Education; Linear Technology SPICE; CMOS; Deep learning; Radial Knowledge Framework

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1. Introduction

With the rapid development of Internet of Things (IoT) technologies, their extensive applications have permeated various sectors, including industry, agriculture, healthcare, and transportation, gradually forming a vast and interdisciplinary industrial ecosystem. As a technology-driven field, the fast-paced evolution of IoT demands

a large number of highly skilled engineering professionals who possess both solid theoretical foundations and strong hands-on capabilities ^[1]. However, the current teaching models in IoT engineering programs at domestic universities generally suffer from insufficient practical training and a disconnect between theoretical instruction and industry requirements, leading to a talent gap that fails to meet enterprise expectations. Therefore, there is an urgent need for higher education institutions to explore innovative teaching approaches and practical methodologies to enhance instructional effectiveness and students' comprehensive practical abilities ^[2].

Very-Large-Scale Integration (VLSI) technology, as a key enabler within the IoT industrial chain, plays a decisive role in determining the performance and market competitiveness of IoT devices. The emergence and continuous advancement of VLSI design automation tools have provided substantial support for hardware design in the IoT domain, while also offering new pathways and perspectives for engineering education. These tools not only significantly improve design efficiency but also enable intuitive simulation and analysis, making complex circuit principles more accessible and comprehensible, thereby addressing the limitations of traditional teaching models, such as abstract theory and lack of practical engagement ^[3].

This study addresses the existing deficiencies and challenges in the teaching of university-level IoT engineering programs by placing VLSI design automation tools at the core. It investigates how these tools can be effectively integrated into IoT-related curricula. By incorporating industry-recognized design automation platforms such as LTSPICE, the study aims to establish a systematic learning pathway that bridges theory and practice, allowing students to grasp the fundamentals and methodologies of integrated circuit (IC) design while gaining familiarity with advanced industrial design standards and workflows. Furthermore, this research emphasizes the integration of emerging technologies—such as artificial intelligence, deep learning, and autonomous driving—into instructional case studies, thereby enhancing the modernity and applicability of the curriculum, stimulating students' interest in IC design, and improving their analytical and problem-solving capabilities in real-world engineering scenarios ^[4].

Through this teaching practice, the study seeks to address key issues in current IoT engineering education, including the theory-practice divide, outdated curriculum content, and insufficient practical skills among students. It further aims to develop a novel teaching model and methodology that not only improves instructional effectiveness but also cultivates high-quality talent aligned with industry demands ^[5]. Ultimately, the findings of this research will contribute valuable experience to the construction of IoT engineering courses in higher education and serve as a meaningful reference for educational reform in related fields.

2. Implementation plan for teaching support using VLSI design automation tools

2.1. Constructing a radial knowledge framework centered on CMOS devices

The foundational IoT hardware course positions CMOS semiconductor devices as the core of instruction, aiming to establish a comprehensive and in-depth radial knowledge framework based on the interconnection of “Device–Model–Circuit–System” ^[6]. This pedagogical model breaks away from the traditional isolated teaching of discrete knowledge points, instead organizing course content in a more systematic and integrative manner. First, by introducing device characteristics, students are enabled to intuitively understand the physical structure, operational principles, and performance parameters of CMOS devices. Second, through tightly linking theoretical modeling, students gain insights into how device models influence circuit behavior. Next, building upon these models, the course extends to practical circuit design and analysis, enabling students to master basic unit circuit design techniques and their real-world applications. Finally, the system-level construction of complex

IoT architectures based on these fundamental circuits is explored, helping students to grasp how theoretical knowledge is translated into practical systems.

Throughout this process, the use of VLSI design automation tools such as LTSPICE plays a critical role in supporting teaching practice. These tools offer robust simulation and analytical capabilities that visually present dynamic signal changes within circuits, assisting students in understanding abstract theories more clearly. This comprehensive and structured approach to knowledge development helps students form a solid conceptual foundation and achieve higher-level professional competence, significantly enhancing the effectiveness of the course.

2.2. Visualized instruction using LTSPICE simulation tools

Traditional instruction in semiconductor physics is often overly abstract, making it difficult for students to intuitively understand complex physical phenomena and circuit operations, which in turn reduces learning engagement and efficiency. To address this issue, this study advocates the use of LTSPICE as a simulation tool to support visualized instruction and enhance the presentation of theoretical knowledge ^[7]. LTSPICE is a powerful, industry-grade simulation platform featuring a highly intuitive graphical interface and real-time simulation capabilities, capable of accurately modeling actual circuit behavior.

In practical implementation, instructors use LTSPICE to design canonical CMOS circuit models, clearly demonstrating the structural characteristics and functional principles of devices. Students observe dynamic changes in node voltages and current waveforms during simulation, allowing them to visualize how theoretical concepts manifest in actual behavior. For instance, through simulation exercises involving CMOS inverters, differential amplifiers, and logic gates, students can clearly follow the circuit operation from the device level to the system level, deepening their understanding of how device performance impacts overall circuit functionality.

Additionally, the use of LTSPICE enables instructors to identify and explain issues students encounter during laboratory experiments in real time, thereby closely integrating theoretical learning with hands-on practice and enhancing students' problem-solving abilities ^[8]. Through this approach to visualized instruction, students not only develop a deep understanding of CMOS device fundamentals and circuit design principles but also cultivate engineering thinking and practical skills, laying a solid foundation for advanced coursework and future engineering applications.

2.3. Practical instruction with industrial SPICE models and process parameters

To ensure alignment between educational content and real-world industrial demands, this study incorporates industrial-grade SPICE models and process parameters, such as the 45 nm Silicon-on-Insulator (SOI) technology, into practical teaching using the LTSPICE simulation platform. Unlike traditional teaching methods, this approach allows students to work directly with device parameters and circuit models used in industry, leading to a deeper understanding of the sophistication and complexity of semiconductor manufacturing processes.

In practice, instructors design representative circuit case studies that guide students in conducting simulation-based analysis using industrial SPICE models. By observing node voltages, current waveforms, and circuit performance metrics under realistic process constraints, students gain insight into how fabrication parameters influence design outcomes. This method not only enhances students' theoretical understanding but also significantly improves their practical skills and ability to address real engineering challenges, ultimately fostering talent that better meets the demands of the semiconductor industry.

2.4. Integrating emerging technologies to stimulate student interest

To further cultivate student interest in VLSI design, this study integrates instructional content with cutting-edge technological applications, including artificial intelligence (AI), deep learning, and autonomous driving systems ^[9]. Through a case-based approach, students are introduced to real-world design needs of intelligent hardware chips, helping them recognize the critical role of IC design in modern IoT innovation. For example, in the context of autonomous driving, instructors may elaborate on core circuit components in self-driving chips and use simulation cases to explain the design principles and implementation strategies behind these high-tech systems.

Additionally, examples such as AI processors and deep learning accelerators are included to demonstrate how specific circuit architectures support the real-time execution of complex algorithms. This integration of practical, high-impact applications helps stimulate students' motivation and curiosity, while also enhancing their engineering mindset and capacity for innovative design.

3. Implementation plan and procedures

3.1. Curriculum development phase

The first year of this study focuses on curriculum development, specifically constructing a knowledge framework centered on CMOS devices and designing detailed instructional content based on this core ^[10]. In implementation, the teaching team will begin by reviewing the current syllabus for the foundational IoT hardware course, identifying key knowledge areas centered on CMOS semiconductor devices, and mapping their relationships with adjacent knowledge modules to construct a radial “Device–Model–Circuit–System” structure.

To ensure scientific rigor and comprehensiveness, the team will consult high-quality IoT and VLSI design textbooks and recent academic literature, incorporating industry needs to develop targeted teaching plans. Industrial-grade simulation software, LTSPICE, will be introduced as an instructional aid to design preliminary hands-on cases that integrate theoretical learning with practical simulation.

During the initial course delivery, instructors will use lectures and demonstrations to present the architecture and content of the knowledge network. Multiple teaching methods—including in-class interaction, group discussion, assignments, and simulation labs—will be employed to gather comprehensive feedback from students. In particular, during simulation sessions ^[11], students will be guided in using LTSPICE to perform basic CMOS circuit simulations, helping them visually comprehend core concepts.

Regular feedback and evaluation mechanisms will also be implemented, such as surveys and discussion sessions, to collect detailed student feedback on the knowledge framework and teaching practices. This feedback will be used to dynamically refine and improve the curriculum. Through this first year of exploratory practice, the teaching team will accumulate valuable experience and establish an initial, practical, and effective teaching methodology and content system, laying a solid foundation for future course enhancement.

3.2. Simulation practice phase

In the second year, this study will focus on in-depth circuit design practice by fully incorporating LTSPICE, an industrial-grade simulation tool, into teaching. This will enable students to strengthen their understanding of IoT hardware fundamentals through hands-on simulation experiences. The teaching team will further develop and refine simulation case studies, incorporating real process parameters such as the 45nm silicon-on-insulator (SOI) technology to ensure simulations closely reflect real-world industrial scenarios.

Students will be guided through the design and simulation of specific circuits. By closely observing node voltages, current waveforms, and circuit performance indicators, they will be led to discover and analyze practical design challenges and corresponding solutions. Additionally, technical lectures and seminars will be organized to help students master advanced simulation techniques and understand the nuances of modern process technologies.

Students will work in teams to complete a series of progressively challenging simulation projects, culminating in comprehensive project reports or papers. These deliverables will be used to evaluate their understanding and practical application skills. The teaching team will provide feedback and targeted suggestions to ensure students achieve meaningful progress and competence. Moreover, the teaching team will document and publish the outcomes of this year's simulation practice in educational research papers, summarizing both pedagogical experiences and the effectiveness of simulation-based instruction.

3.3. Curriculum refinement and dissemination phase

In the third year, the focus will be on synthesizing and optimizing the results of the previous phases to further refine the overall instructional framework for the IoT hardware foundation course. The teaching team will conduct a comprehensive analysis of prior achievements and remaining challenges, with particular attention to student feedback and actual instructional outcomes, to systematically improve the course structure.

This phase will result in a more stable and mature instructional model and curriculum architecture. Key deliverables will include a clearer and more coherent knowledge structure, more diversified and enriched simulation content, and case studies better aligned with real-world industry needs. The team will also author formal teaching reform papers, summarizing innovations in pedagogy, tool integration outcomes, and the enhancement of students' practical engineering skills.

In parallel, the research findings will be actively promoted through teaching conferences, academic seminars, and journal publications, encouraging adoption and adaptation by other universities with similar IoT-related programs. A final project report will be prepared, comprehensively summarizing the implementation process, core outcomes, and future application prospects. This will form a replicable and scalable teaching reform model, contributing meaningfully to the advancement of IoT education and its alignment with industry requirements (**Figure 1**).

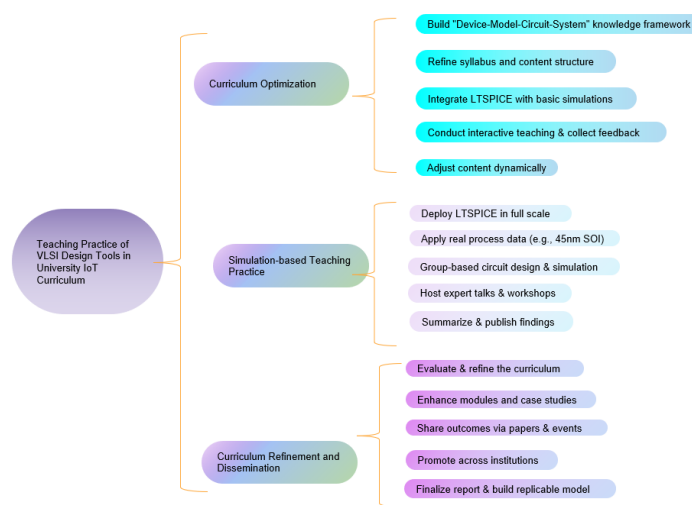


Figure 1. Flowchart of teaching practice using VLSI design tools in university IoT curriculum.

4. Conclusion

This study addresses the common challenges in current IoT engineering education at the university level, particularly the lack of practical training and the disconnect between theoretical instruction and industry demands. It proposes and implements an innovative teaching model centered on the use of Very-Large-Scale Integration (VLSI) design automation tools. By constructing a radial knowledge network focused on CMOS semiconductor devices, the study systematically integrates and optimizes instructional content for IoT-related courses.

Through the adoption of LTSPICE, an industrial-grade simulation platform, a series of intuitive and visualized teaching practices were conducted, significantly enhancing students' comprehension of complex circuit principles and their hands-on practical skills. Furthermore, by incorporating real industrial SPICE models and advanced process parameters, students gained deeper insight into the challenges and technical details of real-world design, substantially improving their professional competence and employment competitiveness.

In addition, the curriculum is closely aligned with emerging technologies such as artificial intelligence, deep learning, and autonomous driving. This integration has proven effective in stimulating students' learning interest and creative engagement, thereby significantly improving overall instructional outcomes.

Over three years of continuous implementation, the project is expected to yield a mature teaching model and practical instructional system. A series of academic papers on teaching practice and pedagogical innovation will be published, contributing a wealth of experience to educational reform. The outcomes of this study will provide valuable reference and practical guidance for the development of IoT engineering curricula in higher education, forming a scalable and transferable teaching reform model. Ultimately, it will promote continuous improvement in both the quality of IoT education and its alignment with evolving industry demands.

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References

- [1] Duan Y, Nie W, Meng Z, et al., 2024, Research on Teaching Problems and Countermeasures for IoT Engineering Courses in Colleges Under the Context of Emerging Engineering Education. *University*, 2024(35): 175–178.
- [2] Yang F, Xu N, Yang R, et al., 2024, Exploration and Research on Practical Course Teaching Modes for IoT Engineering Majors in Applied Universities. *Internet of Things Technologies*, 14(7): 159–162.
- [3] Li P, Liu H, Zhang L, et al., 2023, Construction of an Innovation and Entrepreneurship-Oriented Teaching System for Introductory Courses on IoT Science and Technology. *The Theory and Practice of Innovation and Entrepreneurship*, 6(19): 37–39.
- [4] Wang X, Huang B, Huang Q, 2023, Research on Teaching Reform of “IoT Innovative Comprehensive Practice” Course. *Hua Zhang*, 2023(2): 48–50.
- [5] Li C, 2022, Application of Blended Teaching Approaches in IoT Courses. *Science & Technology Information*,

20(24): 186–189.

- [6] Liu Z, Gao Z, Liu S, et al., 2025, Exploration and Practice of Semiconductor Device Physics Curriculum Reform Driven by the Demands of Material Majors. *Journal of Higher Education*, 11(7): 60–63.
- [7] Chang X, 2025, Application of LTspice Simulation Software in Physics Teaching—A Case Study on Overcoming Teaching Difficulties of “Capacitance of Capacitors”. *Physics Bulletin*, 2025(1): 120–123.
- [8] Cao S, 2025, Exploration and Practice of Ideological and Political Education in IoT Courses: A Case Study of the “Sensor Network Application Development” Course. *Journal of Hebei Vocational University of Technology and Engineering*, 42(1): 30–34.
- [9] Feng P, Tang R, Chen X, et al., 2025, Discussion on Integration Model of Basic Engineering Teaching and Artificial Intelligence in Colleges and Universities. *The Science Education Article Collects*, 2025(6): 86–90.
- [10] Wang Y, 2025, Teaching Practice of the Fundamentals of Internet of Things (IoT) Technology in High School Information Technology Courses. *Anhui Science and Technology Newspaper*, 2025-03-07(014).
- [11] Wang W, Fan X, Hao D, et al., 2025, Exploration and Practice of Teaching Reform for the Course “Introduction to IoT Engineering”. *Internet of Things Technologies*, visited on March 28, 2025, <http://kns.cnki.net/kcms/detail/61.1483.TP.20250124.1727.002.html>.

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Exploration and Application of Educational Elements in Botany Teaching from Ideology and Politics Education

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Abstract: The unique history, culture and national conditions of China determine that professional course teachers should be unified in imparting professional knowledge, value guidance and ability cultivation when teaching. Botany is an important basic course for biology and related majors in colleges and universities. In the process of botany teaching, teachers should absorb and learn from the rational core of Western theoretical achievements to improve the quality of teaching. At the same time, based on Chinese reality, they should take China and time as a reference to solve Chinese problems, show Chinese wisdom, and present Chinese style. This is not only the basic requirement of curriculum ideology and politics, but also the fundamental requirement of the college to train the new people of the era.

Keywords: Botany teaching; Educational elements; The value of life; Scientific literacy; Ecological civilization

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1. Introduction

During his inspection and research at Renmin University of China, General Secretary Xi Jinping emphasized that “The essence of ideological and political theory courses lies in explaining principles. It is essential to focus on methods and approaches, to explain the principles thoroughly, deeply, and vividly. Teachers should teach with dedication, and students should understand with diligence to achieve the goals of communicating hearts and minds, enlightening wisdom and nurturing the spirit, and inspiring morale.” This important discussion provides a new direction and practical path for teachers to make good use of the main channel of classroom teaching in the new era and cultivate a good field of responsibility to realize the same direction of various courses and ideological and political theory courses, and realize collaborative education ^[1]. However, to realize the unity of the three in the actual curriculum teaching, teachers are required to actively explore the ideological and political education elements of professional courses in teaching, integrate these elements into the curriculum objectives and contents, and optimize the teaching structure and mode. The ideological and political education elements

such as excellent traditional Chinese culture education, ideal and belief education, outlook on life and values education, professional quality education and ecological civilization education are organically and closely combined with the knowledge and skills imparts inherent in various courses, to promote the free and all-round development of students and give full play to the role of cultivating morality and people in the new era ^[2,3].

The freshman year of university is a critical transitional period for undergraduates to establish a correct worldview and cultivate lofty ideals and goals. However, freshmen often encounter a multitude of psychological challenges, including adaptation to new living environments, navigation of interpersonal relationships, adjustment to academic demands, and the development of self-identity ^[4,5]. Especially in terms of learning adaptation, there will be maladjustment of learning attitudes and goals, which will lead to some soul-searching questions: “What should I do in this course?” “Do I have dreams for this major?” “I am so confused, do I have clear goals and plans? Are the goals and plans in line with the actual situation of the major?” These ideological issues cannot be deeply answered by ideological and political course teachers and counselors. Therefore, it is urgent for professional course teachers to help students answer their souls subtly in the teaching process ^[6]. Botany is a professional basic course for biological and applied biological science majors in colleges and universities, which is concentrated in the first year of university ^[7]. It is the best time for botany teachers to actively explore the elements of substantive curriculum ideology and politics and practice, improving the teaching model. Effectively integrating the elements of curriculum ideology and politics into students’ daily lives, combining the teaching of professional knowledge with students’ current psychological confusions, and consciously addressing the real problems they encounter in learning and social practice, can truly resonate with their cognitive and practical depths, positively influencing them. This approach aims to cultivate students with lofty scientific literacy and a sense of responsibility, which is also the ultimate goal for botany teachers in achieving the multiple unity of knowledge transfer, value shaping, and ability cultivation.

2. The exploration of ideological and political elements in botany curricula

The breadth and depth of botany instruction are considerable. In terms of depth, it encompasses the morphological characteristics, development, and physiological functions of plant cells, tissues, and organs (vegetative and reproductive), as well as the characteristics and evolution of major plant groups, and the fundamental theories and methods of angiosperm classification. In terms of breadth, it involves both abstract and difficult-to-understand professional terminology and systematic principles, as well as the close connections between plants and various aspects such as politics, economics, culture, and society. Therefore, it is a practical issue for every botany instructor to consider how to use botany as the basic carrier for curriculum-based ideological and political education, identify the points of convergence between professional knowledge and “ideological and political content,” explore curriculum-based ideological and political elements, and achieve the educational effect of subtly influencing students. **Table 1** shows the list of ideological and political elements corresponding to botany topics.

Table 1. List of ideological and political elements corresponding to the teaching knowledge points of botany topics

Curriculum learning objectives		Integration of ideological and political elements into the curriculum		Civic and moral education materials	Practical methodologies	Achievement of objectives
Introduction	Flora and plant diversity	Elements of ecological civilization education		Documentary on the List of Wild Plants under National Key Protection: "Chinese Plants That Changed the World"	Provide supplementary multimedia resources, such as documents and videos, to facilitate student learning outside of class	Cultivate ecological conservation awareness
	The objectives of botanical studies	Ideological and belief components		The story of botanist Wu Zhengyi, who could predict the arrival of autumn by observing a single leaf	Classroom lecture prompts	Cultivate a steadfast commitment to the ideals and principles of botanical scholarship
	A Brief History of Botanical Research	Elements of education in the outstanding traditional culture of China		"The Shijing", a collection of poems dating back to the Spring and Autumn period "The Shennong Ben Cao Jing", dating back to the Qin and Han dynasties. Li Shizhen's "Compendium of Materia Medica" "Flora of China"	The lecture will provide supplementary materials for students to review and reinforce concepts outside of class.	Cultivate cultural competence, and stimulate enthusiasm and interest in learning.
	Seed structure and classification	Incorporating elements of life philosophy and value systems education		"Sowing the Future" and "Stories of China" pay a touching tribute to botanist Zhong Yang's "Life of Seeds"	In class, stories about scientists are told and video materials are provided for students to enjoy after class	Learn from the spirit of pioneers, be courageous to overcome learning difficulties, and actively establish a correct outlook on life and values
Seeds and seedlings	Seed structure of grasses	Elements of professional literacy education		Yuan Longping and hybrid rice	Classroom tells stories of scientists	Study scientist spirit and establish scientific view
	Structure and function of roots	Dialectical view of materialism		The roots are deep and the trees are flourishing	classroom lecture	Dialectical thinking about causes and effects leads students to build a strong foundation for life
The stalk	Structural features of the stems of monocotyledonous and dicotyledonous plants	materialist dialectical view		Structure determines function, function reflects structure	classroom lecture	
	Leaf photosynthesis	Elements of ecological civilization education		Peak Carbon, Carbon Neutral, Carbon Emissions Trading	Presentation of current news related to the profession	Deep understanding of everyone's responsibility to reduce carbon emissions

Table 1 (Continued)

Curriculum learning objectives	Integration of ideological and political elements into the curriculum	Civic and moral education materials	Practical methodologies	Achievement of objectives
Botanical classification	The significance of plant taxonomic studies	Tu Youyou and Artemisinin	Classroom tells stories of scientists' characters	Motivation to learn about the spirit of scientists and the concept of science
	Elements of professional literacy education	Zeng Xiaolian and Botanical Painting	Classroom tells stories of scientists' characters	
	Phytoplankton	Zhong Guan Guan, Qian Chongshu, Hu Xianying, Chen Huanyong and others and Research on Plant Taxonomy	Provide video materials for students to enjoy after class	Understand that the tension of life is not necessarily the idleness and quietness that it appears to be.
	Mossy plant	Academician Zeng Chengkui and Artificial Kelp Culture	Classroom tells stories of scientists' characters	
	Brake	Yuan Mei's Inspirational Poem on moss, "Moss"	Classroom lecture	
Campus Plant Surveys and Field Practicums	Brake	The Story of Cyathea and the Dinosaurs	Classroom lecture	Understanding that the evolutionary process is well documented
	Elements of professional literacy education	Qin Renchang and the fern classification system	Classroom lecture	Respect for practice, the pursuit of scientific truth, and respect for the profession
	Angiosperm	The Spirit and Spirituality of Pine, Grass, Lotus, Plum, Orchid, Bamboo and Chrysanthemum	Classroom lecture	Passing on valuable cultural heritage while learning about the spirituality of plants
	Elements of education in the outstanding traditional culture of China	Relationship of the 24 Solar Terms to Agricultural Activities and Plants	Classroom lectures, post-class video materials to enjoy	Fully understand the importance of treasuring endangered plants and enhance the awareness of the protection of wild plant resources
	Elements of education in the outstanding traditional culture of China	"Convention on International Trade in Endangered Species of Wild Fauna and Flora"		
Plant Resources Survey and Conservation	Elements of ecological civilization education	"Convention on Biological Diversity"		
	Plant Resources Survey and Conservation	Rhododendron, Solanum, Orchidaceae and other State conservation cases of key protected wild plants	Practical Learning	Philosophical principles of commonality and individuality
	Field Practicums	Seed Law of the People's Republic of China		
		Chinese herbal medicine original plant		
		Identify plants and understand the commonality of morphological features of major families and the individual characteristics of specific species		

2.1. Ideological and belief education elements

At the commencement of the botany course, the instructor should elucidate the significance of botanical knowledge in the inaugural lesson, thereby reinforcing students' professional ideals and commitment to their studies. The first lesson should clarify the objectives of studying botany, emphasizing that “no knowledge is useless, and no knowledge is unlearnable.” Botany is not only a fundamental course in life sciences but also closely related to national economic development and the resolution of major global issues, including food security, environmental sustainability, public health, and peace. Instructors should inspire students to aspire to great ideals and take responsibility for national rejuvenation, passionately introducing the story of Wu Zhengyi, a botanist and recipient of China's highest science and technology award. In 1951, during the Korean War, 35-year-old Wu Zhengyi identified variants of *Litsea cubeba* varieties and *Quercus coccinea*, both native to South Korea, amidst a multitude of similar-looking fallen leaves. Through botanical identification, he provided evidence of the U.S. military's biological warfare in Korea. In 1933, when Wu Zhengyi was about to apply to Tsinghua University for botany, his father asked him, “What's the use of studying this?” At that time, he couldn't answer. Through his outstanding contributions to botanical research, 92-year-old Wu Zhengyi received the 2007 National Highest Science and Technology Award. In a media interview, he said, “My father once asked me what the use of studying plants was. I couldn't answer then, but I can now.” By sharing Wu Zhengyi's lifelong dedication and his profound understanding of the world through the study of plants, instructors aim to ignite students' pride in studying botany, thereby strengthening their ideals and beliefs in their chosen field.

2.2. Elements of life philosophy and value education

The introductory botany course presents a substantial volume of information, encompassing a broad spectrum of knowledge, numerous concepts, and specialized terminology. The target audience for this course comprises first-year undergraduates. These students often exhibit limited prior academic experience, a narrow knowledge base, underdeveloped abstract reasoning skills, and insufficient capacity for knowledge transfer^[8]. Furthermore, they are undergoing a transition from passive learning in secondary education to a more autonomous learning approach at the university level. During this challenging transitional period, students lacking resilience, those unable to confront difficulties and setbacks, may lose their motivation and enthusiasm for learning, leading to a negative attitude towards the specialized subject matter. Consequently, instructors must not only facilitate students' comprehension of complex botanical content but also utilize the course material to guide students in developing a sound worldview and set of values.

In the instructional process, it is appropriate to inspire and motivate students through the incorporation of compelling narratives of scientists. This approach aims to cultivate students' resilience in the face of challenges, fostering their dedication to learning, a strong work ethic, and a sense of responsibility. The ultimate goal is to equip them with the ability to address practical issues within their field of study. For instance, during the “Seed Structure and Types” module, educators can integrate the life of botanist Mr. Yang Zhong, whose 16-year commitment was dedicated to the investigation and analysis of plant resources on the Qinghai-Tibet Plateau. Despite the harsh environmental conditions and life-threatening risks, he persevered in his expeditions to Tibet, expending considerable effort to collect a treasure trove of over 40 million seeds representing more than 1,000 plant species. This work provided a comprehensive understanding of the distribution of biological resources in Tibet, filling significant gaps in the research of Tibetan flora. As Mr. Zhong articulated in his writings, “When a species seeks to expand its territory, it must confront the challenges of a hostile environment, with some pioneers sacrificing individual advantages to secure new survival and development opportunities for the entire group and

even the species.” By studying the pioneering spirit of Mr. Zhong, students can develop the courage to overcome academic difficulties and actively explore the world of botany, thereby realizing their lofty life values.

2.3. Elements of professional ethics education

In the 21st century, human society has entered an era of intelligent technology. Biotechnology, along with information technology and materials technology, constitutes the three major driving forces behind artificial intelligence, representing the fastest-growing high-tech fields globally. As one of the world’s four major pillar industries, the biotechnology industry exhibits strong technological versatility, product diversity, and resource richness. Consequently, life science programs in higher education institutions must adopt a national and even global perspective to cultivate biotechnology professionals with a solid foundation of specialized knowledge, comprehensive professional qualities, and robust innovative and practical abilities ^[9]. Instructors teaching the foundational life science course of “Botany” are thus required to closely integrate teaching content with professional ethics education, guiding students to not only diligently acquire scientific knowledge but also to cultivate a correct scientific attitude, establish a scientific spirit, and foster a meticulous work ethic and a strong sense of social responsibility.

Scientific spirit and professional ethics are the most valuable spiritual assets when engaging in scientific work, gradually cultivated and developed by students during the process of learning professional knowledge. In the teaching of botany in the freshman year, the instructors should tell the stories of scientists corresponding to different teaching contents. Inspire and enlighten students with the touching deeds of scientists such as Yuan Longping and hybrid rice, Tu Youyou and artemisinin, Zeng Xiaolian and plant painting, Academician Zeng Chengkui and artificial cultivation of kelp, Zhong Guanguang, Qian Chongsheng, Hu Xiansu, Chen Huanyong and plant taxonomy research, Qin Renchang and the classification system of ferns, so that students can recognize that scientists respect practice, pursue scientific truth, and advocate professionalism, thereby planning their own career ideals, and realizing their ideals through dedication and struggle.

2.4. Elements of excellent traditional Chinese culture education

The profound and intricate nature of China’s outstanding traditional culture encompasses a wealth of philosophical thought, humanistic spirit, and moral principles, offering subsequent generations invaluable intellectual resources for understanding and transforming the world. As President Xi Jinping emphasized in his 2013 address at the Central Party School’s spring semester commencement, “Leading cadres must also study China’s outstanding traditional culture to enhance their wisdom and cultivate their character through learning” ^[10]. China, being one of the earliest nations to study and utilize plants, has amassed a significant body of Chinese cultural elements that utilize plants as their medium. Educators can enrich the ideological depth of the curriculum, cultivate students’ cultural confidence, and stimulate their enthusiasm and interest in learning, thereby facilitating the effective completion of botany course objectives, by skillfully and appropriately integrating education on China’s outstanding traditional culture into botany instruction.

Integrating elements of excellent Chinese traditional culture education permeates nearly the entire botany teaching process. In the introductory section, when discussing the history of botanical research, the study introduce the “Book of Songs” from the Spring and Autumn period, the “Shennong Ben Cao Jing” from the Qin and Han dynasties, and Li Shizhen’s “Compendium of Materia Medica” from the Ming Dynasty. These are among the world’s earliest botanical masterpieces, highly valued by botanists. Additionally, the “Flora of China,” published in 2004, and its English version, “Flora of China,” published in 2013, represent one of the

largest and most diverse botanical works globally. The study encourages students to read these botanical classics and take notes, guiding them to appreciate Chinese traditional culture, enhance their national cultural pride and self-esteem, and build confidence in Chinese culture and their professional prospects. When elucidating the characteristics of diverse plant species, the study integrates cultural elements using specific plants as examples. For instance, when discussing the distribution and habitats of bryophytes, the study introduces Yuan Mei's inspirational poem "Moss": "Where sunlight fails to reach, youth arrives on its own. Though moss flowers are as tiny as rice, they strive to bloom like peonies." Moss, a pioneer plant, appears quiescent, yet it grows dynamically through encroachment and coverage, weathering storms and time to adorn the human world. This approach guides students to understand that the vitality of life is not always reflected in its outward appearance of tranquility. For ferns, the study uses the narrative of "Cyathea and Dinosaurs" to illustrate their past and present, helping students grasp the epochs of geological transformation. The decline of these "plant giants" represents the evolutionary journey of ferns over time, with evidence of their past struggles and glory. When teaching about Pinus, the study references the Huangshan Welcome Pine's tenacious spirit of growing through rock to introduce the dialectical relationship of "structure determines function, and function reflects structure." For herbaceous plants, the study incorporates the saying "Wildfire cannot burn them all, the spring wind brings them back to life" to inspire students with the resilience and perseverance of grass. In explaining the life cycle of angiosperms, the study integrates the twenty-four solar terms and their relationship to plant growth and agricultural activities, highlighting the wisdom of ancient Chinese laborers. The study aims for the students to not only acquire professional knowledge but also to inherit this invaluable cultural heritage.

2.5. Elements of ecological civilization education

Over the past few decades, the emphasis on economic development and industrialization has led to a diminished awareness of ecological protection and the overexploitation of resources, resulting in severe environmental degradation. Consequently, the 18th National Congress of the Communist Party of China incorporated ecological civilization construction as a fundamental component of the overall layout of the cause of socialism with Chinese characteristics within the "Five-Sphere Integrated Plan." General Secretary Xi Jinping explicitly stated in the Report of the 19th National Congress of the Communist Party of China that "ecological civilization construction benefits both the present and future generations" and "to adhere to the harmonious coexistence between humanity and nature, we must establish and practice the concept that lucid waters and lush mountains are invaluable assets, and adhere to the basic state policy of conserving resources and protecting the environment" ^[11]. University students are the key players in the future ecological civilization construction of the nation, and cultivating a solid socialist ecological civilization perspective among students is a core educational mission of higher education institutions ^[12]. Therefore, botany instructors, by utilizing the knowledge of botany as a vehicle to conduct ecological civilization education, have an excellent opportunity to cultivate students' environmental protection awareness and promote ecological civilization construction.

Educators can leverage opportunities such as campus plant surveys and field excursions to implement ecological civilization education. This involves fostering discussions with students on "plants and nature" and "plant resources and ecological civilization." In the field, instructors should enthusiastically guide students in appreciating natural landscapes and proactively collect non-biodegradable waste generated during practical investigations. Through practical actions, educators should encourage students to conserve plant resources, minimizing specimen collection unless essential. When encountering plants like *Cyathea*, *Paphiopedilum*,

Cymbidium goeringii, or Cycas, educators should explicitly communicate the concept of wild plant protection, emphasizing legal prohibitions against the collection, sale, or acquisition of nationally protected wild plants. Students should also be instructed to memorize the national key protected wild plant list, thereby enhancing their understanding of the importance of conserving endangered plants and strengthening their awareness of wild plant resource protection. Furthermore, ecological civilization construction is intrinsically linked to plant diversity conservation. When teaching plant diversity, educators should guide students to investigate campus plant diversity and ecological environments during their free time, formulating appropriate conservation plans to initiate ecological civilization construction within the campus. To establish an ecologically civilized and beautiful environment, the concept of low-carbon environmental protection should be instilled in students. During lessons on leaf physiology and structure, educators can introduce concepts such as “carbon peak, carbon neutrality, and carbon emissions” through the principle of “plant photosynthesis consuming carbon dioxide,” enabling students to deeply understand the necessity and strategic significance of the national carbon peak and carbon neutrality goals, emphasizing that reducing carbon emissions is a shared responsibility.

3. Integrating ideological and political elements into the botany curriculum as the main teaching channel

3.1. Expand the scope of the classroom curriculum

Given the constraints of a two-semester botany curriculum, the allocated instructional time is relatively limited. To effectively integrate ideological and political theory (IPT) into the course, instructors should identify relevant IPT elements. They should then address real-world issues encountered by students, strategically selecting IPT content. The goal is to pinpoint the convergence of these IPT elements with the core botanical knowledge. This approach will enrich the explanation of specialized knowledge, encouraging students to engage in extended learning or research. Simultaneously, it will highlight the concise and impactful nature of the IPT education, guiding students to contemplate and investigate pressing societal issues. This strategy aims to enhance the synergistic effect of “IPT” and “specialized knowledge,” thereby leveraging the educational function of the discipline’s culture.

3.2. Innovative pedagogical approaches in the classroom

To effectively integrate ideological and political elements into botany courses, innovative pedagogical approaches are essential. These methods should address students’ intellectual and psychological development, as well as their key concerns. Meticulous refinement of the implementation details and the development of practical teaching plans are crucial. A multifaceted approach should be adopted, including instructor-led lectures, student-led extracurricular study, and both on-campus and off-campus practical experiences. During classroom instruction, emphasis should be placed on stimulating student agency through active learning strategies such as group problem-solving discussions, scenario presentations, research project explorations, in-class debates, and case study analyses to introduce ideological and political content. The extracurricular study component should integrate online and offline resources, leveraging platforms like MOOCs, learning apps, and interactive classroom systems to provide access to files, video materials, relevant news articles, and legal references for students to study outside of class. Students should be encouraged to provide feedback and write reflections after completing these assignments. The on-campus practical component should begin with a survey of campus plant resources, utilizing online information resources to link species information to QR codes that direct to the Flora

of China, thereby promoting plant classification learning throughout the campus and extending the ideological and political education to the entire faculty and student body. The off-campus practical component should utilize external “ideological and political” teaching bases to conduct resource surveys and establish specialized resource gardens, allowing students to participate in the maintenance and propagation management of these gardens. This will enrich teaching resources while implementing the ideological and political curriculum.

3.3. Develop a high-quality ideological and political teaching resource database for botany courses

As botany educators, we should integrate elements of ideological and political education, including the cultivation of excellent traditional Chinese culture, ideals and beliefs, life values, professional ethics, and ecological civilization, into our teaching, aligning with the great practices of the new era. We should incorporate vivid practical achievements and the exemplary deeds of scientists into our lectures, organizing and developing a high-quality, diverse teaching case library. Furthermore, we should dynamically gather students’ concerns regarding learning difficulties and ideological questions, with the faculty collectively researching and providing answers to create a problem bank for botany instruction. We must enrich the ideological and political content of botany courses by actively collecting, reviewing, and sharing outstanding course materials, including lecture notes, key point analyses, domestic and international references, micro-videos, and multimedia open courses, to establish a high-quality teaching resource repository.

3.4. Developing a high-caliber teaching faculty for the ideological and political elements of botany curricula

As emphasized by General Secretary Xi Jinping, a botany educator’s fundamental qualities encompass a robust knowledge base, proficient teaching capabilities, a diligent instructional approach, and effective pedagogical methodologies ^[13]. For a botany course instructor integrating ideological and political elements, continuous enhancement of teaching proficiency and expansion of subject matter expertise are essential for delivering course content. Furthermore, in practical course instruction, educators must clearly define their political stance and continuously elevate their ideological awareness to effectively improve their professional competence and ethical standards. Effective communication among botany instructors is crucial. Collaborative course refinement, involving discussions based on lecture content, instructional challenges, and student feedback, is necessary. This collaborative effort should foster innovation in teaching methods, aiming to transform each ideological and political botany lesson into a high-quality course. The ultimate goal is to cultivate educators who are, in the students’ eyes, idealistic, principled, ethical, and possess a wealth of professional knowledge.

4. Conclusion

The integration of ideological and political elements into botany curricula necessitates a thorough exploration of these elements as a foundational step. Furthermore, the cultivation of a highly qualified teaching staff is essential to ensure the effective amalgamation of specialized knowledge with ideological and political education. By strategically leveraging the content of the discipline and accurately incorporating ideological and political elements, we can assist students in developing sound life philosophies. This approach aims to cultivate students who embody patriotism, professional ethics, and a sense of responsibility, thereby shaping them into exemplary young citizens of the new era. Ultimately, this strategy enables educators to achieve the comprehensive

educational objectives of knowledge dissemination, value formation, and skill development.

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References

- [1] Xi JP, 2016, The Ideological and Political Work Through the Whole Process of Education and Teaching to Create a New Situation for the Development of China's Higher Education. *The People's Daily*, 1.
- [2] National Conference on Education, 2021, 2021 National Education Work Conference Held, viewed on January 9, 2021, http://www.gov.cn/xinwen/2021-01/08/content_5578265.htm.
- [3] Qi ZY, Xin XR, Liang Y, 2022, Effective Mechanism and Action Path for College Teachers to Excavate Ideological and Political Elements. *Heilongjiang Researches on Higher Education*, 40(5): 131–136.
- [4] Liu H, Li Y, 2024, The Reciprocal Effects of Emotional Adjustment, Social Adjustment and Academic Adjustment Among Freshmen: A Longitudinal Study. *Journal Name Missing*, 40(2): 270–278.
- [5] Song X, Hu Q, 2024, The Relationship Between Freshman Students' Mental Health and Academic Achievement: Chain Mediating Effect of Learning Adaptation and Academic Self-Efficacy. *BMC Public Health*, 24: 3207.
- [6] Wang Y, Li L, Hao L, 2020, Problems and Improvement Strategies of "Recessive Education" in Ideological and Political Teaching in Colleges and Universities. *Theory and Practice of Education*, 40(3): 37–39.
- [7] Jin YS, Hou TT, Yin BS, et al., 2019, Teaching Effect of Botany Based on Network Education Platform. *Journal of Biology*, 36(6): 127–129.
- [8] Xiong J, 2023, A Study on the Academic Adaptation and Improvement Measures of Freshmen in "Double First-Class" Universities. *Higher Education Forum*, 2023(9): 77–85.
- [9] Li XY, Yang CQ, Guan LH, et al., 2024, The Curriculum Ideological and Political Operation Mode Helps the Cultivation of Innovative Talents of Biotechnology Major in Universities. *Heilongjiang Researches on Higher Education*, 10(21): 1–6.
- [10] Xi JP, 2013, Xi Jinping Attended the Celebration of the 80th Anniversary of the Founding of the Party School of the CPC Central Committee and Delivered a Speech, viewed on February 24, 2025, https://www.gov.cn/ldhd/2013-03/01/content_2342890.htm.
- [11] Xi JP, 2017, Winning the Comprehensive Completion of a Moderately Well-off Society and Seizing the Great Victory of Socialism With Chinese Characteristics in the New Era—Report at the 19th National Congress of the Communist Party of China. *Vanguard Group*, 2017(31): 4–21.
- [12] Wen J, 2019, Exploration of Ecological Civilisation Education Mode in Civic and Political Science Courses in Colleges and Universities. *New West*, 2019(20): 147, 16.

- [13] Xi J, 2014, To Be a Good Teacher Satisfactory to Both the Party and the People—A Speech at a Symposium With Representatives of Teachers and Students of Beijing Normal University, viewed February 26, 2025, https://www.gov.cn/xinwen/2014-09/10/content_2747765.htm.

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An Empirical Analysis of ChatGPT Translation Error Types in Texts of Chinese Red Culture Based on the MQM Quality Assessment Framework

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Abstract: In recent years, translation quality evaluation has emerged as a major, and at times contentious, topic. The industry view on quality is highly fragmented, in part because different kinds of translation projects require very different evaluation methods. In response, the EU-funded QTLaunchPad project has developed the Multidimensional Quality Metrics (MQM) framework, an open and extensible system for declaring and describing translation quality metrics using a shared vocabulary of “issue types.” As an effective approach to evaluating AI translation quality, the classification of translation errors has drawn increasing attention. This study focuses on translation errors in red texts, using the MQM quality assessment model as the analytical framework to categorize errors in translations produced by ChatGPT4.0, a leading engine among current large language models. The findings aim to provide pedagogical support for pre-editing and post-editing training in professional translator education.

Keywords: AI translation; ChatGPT; Multidimensional quality metrics; Error types

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1. Introduction

Since its proposal by Warren Weaver in 1949, machine translation has undergone multiple transformations at its core, reflecting humanity’s ongoing pursuit of high-quality automated translation. In recent years, machine translation based on deep learning has achieved significant breakthroughs, prompting major companies to incorporate it into their R&D strategies and launch online translation engines, such as the widely used Google Translate, DeepL, and Baidu Translate. Although the overall quality of current online machine translation systems for English-Chinese and Chinese-English translation has reached a passable level and can generally fulfill communicative purposes, there remains a gap between the current output and higher-quality standards^[1]. Even Google Translate, a leading engine, occasionally produces errors in Chinese-to-English translation that are

subtle, sometimes so much so that even intermediate English learners may struggle to detect them.

With the rapid development of artificial intelligence and natural language processing technologies, AI translation tools have become increasingly significant in cross-cultural communication. ChatGPT, developed by OpenAI, is a large-scale generative language model based on the GPT (Generative Pre-trained Transformer) architecture. Trained on massive amounts of textual data using deep learning techniques, particularly transformer-based neural networks, ChatGPT is capable of understanding and generating human-like text across a wide range of contexts. Since its release, it has been widely adopted for tasks including content creation, code generation, question answering, and language translation. As a representative of advanced large language models (LLMs), ChatGPT has significantly influenced the fields of natural language processing and AI translation, pushing the boundaries of what AI-generated language can achieve.

The emergence of generative AI tools such as ChatGPT has accelerated the evolution of neural AI translation technologies. While research on machine translation continues to flourish both in China and abroad, there remains a lack of consensus regarding evaluation methods for translation quality and standardized classification of translation errors^[2]. Although certain metrics, such as the widely recognized SAE J2450 and the LISA QA Model, are available for assessing translation quality, the former is limited by its industry specificity and lacks generalizability, while the latter adopts a “one-size-fits-all” approach, sacrificing flexibility. Automatic evaluation metrics such as BLEU, METEOR, and TER can reflect the overall quality of AI translations but fail to identify specific issues in the output and tend to marginalize the role of human evaluation^[3]. For a long time, the industry has lacked a method capable of classifying AI translation errors tailored to specific client needs and text types, and of proposing acceptability standards based on such error types^[4]. In response, the Multidimensional Quality Metrics (MQM) framework was developed.

The MQM (Multidimensional Quality Metrics) quality assessment model is one of the outcomes of the EU-funded QTLaunchPad project. It is a dynamic, comprehensive, and customizable framework for evaluating both source and target texts. The model offers a hierarchical classification system comprising 108 error categories, each clearly defined and distinguished. This layered structure integrates mainstream quality evaluation approaches—such as the TAUS Dynamic Quality Framework, the LISA QA Model, and SAE J2450—with quality assurance tools like ApSIC Xbench, CheckMate, and XLIFF:doc, as well as theoretical models of multidimensional machine translation evaluation^[5]. At the top level, the MQM framework categorizes translation issues into five dimensions: Fluency, Accuracy, Verity, Design, and Internationalization, along with a supplementary “Other” category for uncategorized issues, forming a tree-like structure. To facilitate practical application and data analysis, the model also provides a streamlined version known as the MQM Core, which includes 19 error categories—three parent categories and sixteen subcategories (see **Figure 1**). Moreover, the MQM model assigns specific weightings to each error type and classifies them by severity into Critical, Major, Minor, and None. It further offers a formula for calculating translation quality: $TQ \text{ (Translation Quality Score)} = 100 - TP \text{ (Translation Penalty)} + SP \text{ (Source Penalty)}$ ^[6]. The MQM model (**Figure 1**) truly adopts a user-centered approach, enabling users to assess translation quality across various standards, levels, and degrees of granularity^[7].

This paper aims to conduct an empirical analysis of translation error types produced by ChatGPT when translating texts of Chinese Red Culture, using the MQM quality assessment framework as the analytical tool. By classifying and analyzing the nature and severity of translation errors, the study seeks to identify systematic weaknesses in ChatGPT’s handling of such texts and to provide insights that may inform both MT improvement and translator training, particularly in pre-editing and post-editing practices.

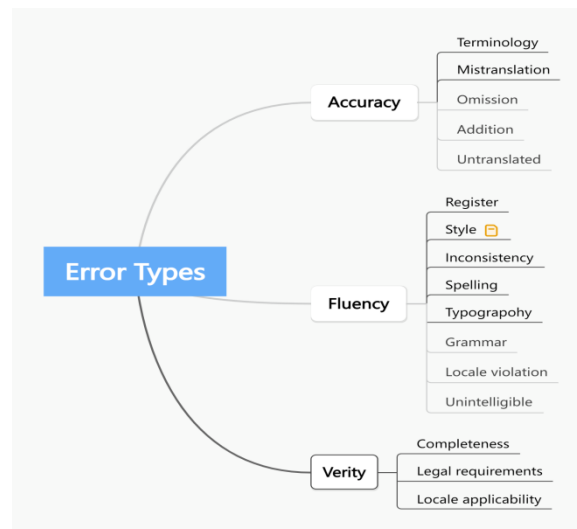


Figure 1. MQM core with error types.

2. Literature review

In recent years, neural machine translation (NMT) based on deep learning has gradually become mainstream, achieving breakthroughs in semantic understanding and contextual awareness through training on massive corpora. Online translation engines such as Google Translate, DeepL, and Baidu Translate have demonstrated considerable advancements in English-Chinese and Chinese-English translation, though issues with nuanced or domain-specific content persist ^[8]. For instance, Baidu’s Chinese-English translation system significantly improved its handling of Chinese-specific vocabulary (such as idioms and colloquialisms) from 2017 to 2019 by optimizing its models. Similarly, domestic large models like DeepSeek have enhanced their ability to recognize technical terms and disciplinary associations through the construction of knowledge graphs, and have already been applied in the automatic summarization of academic literature. These technologies provide a technical foundation for translating complex historical terms in red culture texts. Such texts often contain unique expressions related to revolutionary historical events, political slogans, and material cultural terms (e.g., “Hongchuan Jingshen,” “Jinggangshan Huishi”), which pose challenges due to semantic gaps and difficulties in conveying intended meaning in the target language. Research shows that while ChatGPT can produce literal translations of material culture terms (e.g., “Tu Su Jiu,” “He Huan Tang”), it often fails to convey the deeper cultural connotations, necessitating human annotation or interpretive translation strategies to compensate. Moreover, red classic texts frequently involve ideological expressions, and AI translation may misrepresent politically sensitive content due to a lack of contextual understanding, highlighting the need for dynamic translation adjustment mechanisms.

Many scholars have already begun to explore the opportunities and challenges that ChatGPT brings to language teaching and academic writing. Salvagno et al. argued that ChatGPT can assist writers in organizing materials, generating drafts, and proofreading, while also acknowledging risks such as plagiarism and inaccuracy ^[9]. Thorp has explicitly expressed serious concerns about the use of ChatGPT in academic writing, asserting that ChatGPT cannot replace the role of the author ^[10]. Wu provided an in-depth analysis of the challenges and methodologies in detecting large language model (LLM)-generated texts. While its focus is on detection rather than translation, the article underscores the increasing indistinguishability between LLM outputs

and human-written texts, raising concerns about authenticity and bias ^[11]. David explored the utility of ChatGPT in providing accurate, actionable, and understandable generative medical translations in English, Spanish, and Mandarin about Otolaryngology ^[12]. Alm et al. explored ChatGPT's role in language education through Freire's critical pedagogy, emphasizing the dual potential of AI tools to either empower or constrain learners, and the study critiques ChatGPT's tendency to replicate dominant cultural norms due to its Anglo-centric training data, a point highly pertinent to this paper's concern with red culture translation ^[13]. Athanassopoulos investigated the effectiveness of ChatGPT in enhancing L2 writing among socially vulnerable students, such as refugees and migrants. The findings demonstrate measurable improvements in vocabulary richness, grammatical accuracy, and sentence length after ChatGPT-assisted revisions ^[14]. While these studies have analyzed the significant impact of ChatGPT on the field of translation, few have paid attention to its translation quality when applied to Chinese-specific discourse. In the context of China's entry into a new era, the theoretical framework and macro perspective for exploring and reflecting on new technologies still require further development. In this context, the Multidimensional Quality Metrics (MQM) framework has gained traction as a flexible and comprehensive quality evaluation model. Developed as part of the EU-funded QTLaunchPad project, MQM enables evaluators to classify translation errors into over 100 fine-grained categories across multiple dimensions, including Fluency, Accuracy, Verity, and Design ^[15]. Compared to earlier evaluation standards such as SAE J2450 and the LISA QA Model, MQM offers greater adaptability and has been integrated with professional translation tools and quality assurance systems. Lommel introduced the hierarchical taxonomy of error types and allowing tailored granularity, and highlighted that MQM enables comparative, systematic translation quality assessments ^[16]. Freitag focused on comparing the professional translator annotations for MT systems in the WMT2020 task. This article demonstrates that MQM error analysis significantly alters system rankings compared to crowd-sourced evaluations and reveals that mistranslation remains the dominant error type in modern NMT outputs ^[17]. Laurer explored the integration of multilingual BERT-based models and machine translation for cross-lingual political text classification. Their empirical findings confirm that transformer-based models can produce valid and substantively meaningful outputs across languages ^[18].

Nevertheless, these studies have provided valuable inspiration for this paper in terms of corpus selection, error type classification, and error avoidance strategies in research design. Despite this growing body of research, few studies have systematically applied MQM to evaluate the output of LLMs like ChatGPT, particularly in the context of culturally and politically embedded texts such as those from Chinese Red Culture. This study aims to fill that gap by combining the strengths of the MQM framework with the unique linguistic characteristics of red-themed discourse, providing new insights into the capabilities and limitations of generative AI in cross-cultural translation.

3. Research design

3.1. Research questions

To avoid the limitations of the "Mentalist View" in translation evaluation and to ensure the standardization and representativeness of translation error classification, this study selects ChatGPT, currently regarded as one of the most advanced large language models (LLM)-based translation systems ^[19], as the subject of evaluation. Using the MQM Core framework, the study systematically assesses the translations generated by ChatGPT. The research aims to address the following three questions:

- (1) What is the overall translation quality of ChatGPT when translating texts related to Chinese Red Culture?

- (2) What are the typical translation error types that occur in ChatGPT's output?
- (3) How can these errors be effectively avoided or mitigated in practice?

3.2. Corpus selection

The selection of appropriate corpora is critical to the reliability and validity of this study's analysis of ChatGPT's translation errors. Given the focus on Chinese Red Culture texts, the corpus used in this study consists of texts that embody key elements of China's revolutionary history, socialist ideologies, and political rhetoric. These texts include, but are not limited to, excerpts from historical documents, speeches by prominent political figures, and literary works that reflect the values and principles associated with the Chinese Red Culture movement.

To ensure the diversity and richness of the corpus, a balanced selection of texts was made, covering various genres and linguistic styles. This includes formal political documents, propaganda literature, and narratives associated with China's revolutionary struggle. The content of these texts is ideologically dense, with terminology and expressions specific to Chinese socialist culture, making them particularly challenging for AI translation systems, especially those trained on general corpora^[20].

The corpus used in this study comprises both short passages and longer texts to assess the performance of ChatGPT in different translation contexts. The selected texts are also carefully annotated to reflect the unique linguistic and cultural features of Chinese Red Culture, which will aid in the subsequent error categorization and analysis.

By focusing on this specific domain, this study aims to provide an in-depth understanding of how ChatGPT handles translations of culturally and politically charged texts and to explore the specific challenges faced by large language models in such contexts.

This study utilizes a self-compiled mini-corpus consisting of 100 carefully selected examples drawn from texts representative of Chinese Red Culture. The selected corpus contains a total of approximately 44,000 Chinese characters, ensuring sufficient textual volume for a reliable and comprehensive evaluation, while remaining manageable for detailed manual analysis. Each text was chosen to reflect diversity in genre, linguistic complexity, and contextual richness, highlighting cultural references, political terminology, and discourse features typical of Chinese Red Culture.

In addition, each of the Chinese texts is accompanied by an official English translation, which serves as a reference version in the comparative analysis between the source text and the translations generated by ChatGPT. Due to the rapid growth in demand for the translation of specialized texts, an in-depth exploration of such texts can enhance the efficiency of both pre-editing and post-editing processes^[21]. It helps quickly identify error types, optimize translation quality, and provide valuable insights for improving AI translation algorithms and training models.

3.3. Statistical procedures

- (1) The selected 100 source texts were individually input into ChatGPT, asked it to translate into English, and the generated translations were collected and archived with proper annotation.
- (2) Following the definitions provided in the MQM Core framework, translation errors were manually identified and annotated after the annotators had gained a thorough understanding of all error types and their definitions. In cases where disagreements arose during the annotation process, decisions were made through group discussion and consensus. Since the MQM Core does not cover all possible error types, any errors not listed in **Figure 1** were categorized under the corresponding parent category or

assigned to the “Other” dimension, concerning the full MQM model. To emphasize the classification of error types—rather than the frequency or severity of repeated instances—each type of error was counted only once per sentence, even if it occurred multiple times. Distinct error types within the same sentence, however, were separately identified and recorded.

- (3) Error Type Statistics and Comparative Analysis. The final statistical results were manually compiled into an Excel spreadsheet. The dataset consisted of two parts: errors manually identified by annotators and errors automatically detected by the platform itself. The percentage of a single error type was calculated by dividing the frequency of that specific error by the total number of errors.

4. Research findings

The statistical results indicate that ChatGPT exhibits several issues in translating Chinese Red Culture texts into English, with the majority of errors concentrated in the dimensions of accuracy and fluency, showing both typified and repetitive patterns (**Table 1**). Although ChatGPT is generally capable of achieving a high degree of equivalence between source and target texts, limitations inherent to its model architecture become apparent when dealing with complex sentence structures, semantic ambiguity, and multiple layers of modifiers. These issues are most evident in the accuracy dimension, where errors such as terminological inappropriateness and misinterpretation of information, often caused by over-adherence to source text syntax, are prevalent, leading to a total error rate of 73.69%.

Admittedly, AI translation systems, including ChatGPT, operate primarily at the sentence level, with translation rules and matching mechanisms designed around sentence units. This results in limited consideration of broader contextual factors such as paragraph structure or discourse cohesion. Consequently, translation strategies such as antithesis, summarization, and omission—commonly used by human translators—are rarely employed^[22], negatively impacting fluency. For example, in the parallel texts examined in this study, ChatGPT often neglected or misrepresented structural consistency in handling parallel elements and subheadings, leading to decreased readability across sentences. The total error rate for fluency-related issues reached 28.94%. Moreover, the use of functional words such as conjunctions, participles, and pronouns was frequently problematic, contributing an additional 21.05% to the fluency error rate.

According to the MQM framework, the Verity dimension refers to cases in which a factually true statement in the source language becomes false in the target language, covering issues such as procedural completeness, regulatory compliance, and regional applicability. However, no such errors were identified in this study. Therefore, the analysis focuses on the accuracy and fluency dimensions. In the following sections, representative examples of frequent errors in these two areas will be presented and discussed in detail.

Table 1. Statistics of error types of ChatGPT

Error Types	Frequency	Percentage (%)
Accuracy	28	73.69
Terminology	9	23.68
Mistranslation	19	50
Omission	-	-
Addition	-	-

Table 1 (Continued)

Error Types	Frequency	Percentage (%)
Untranslated	-	-
Fluency	11	28.94
Register	-	-
Style	-	-
Inconsistency	3	7.89
Spelling	-	-
Typography	-	-
Grammar	8	21.05
Locale violation	-	-
Unintelligible	-	-
Verity	0	0
Completeness	-	-
Legal requirements	-	-
Locale applicability	-	-
Total	38	100

4.1. Accuracy dimension

According to the MQM quality assessment framework, the accuracy dimension refers to errors in which the target text fails to accurately convey the meaning of the source text, excluding any authorized or intentional deviations. This dimension includes issues such as terminology errors, mistranslations, omissions, additions, and untranslated segments. It is important to note that within the MQM framework, “terminology” is defined as the use of a term in the target language that differs from the expected or conventional usage in the relevant field. In this translation practice, no issues of omission, addition, or untranslated content were found. Therefore, the following discussion will focus solely on terminology errors and mistranslations.

4.1.1. Terminology errors

AI translation systems, including ChatGPT, benefit from extensive training on large-scale corpora, enabling them to correctly render most domain-specific terms. However, due to the flexible and context-dependent use of terminology in technical and political discourse, translation errors still occur. These errors often involve unexpected or non-standard terms that deviate from the conventional usage within the domain, thereby reducing the accuracy and acceptability of the translation.

Example 1

ChatGPT: Beiyang Warlords

Reference: the Northern Warlords

Example 2

ChatGPT: strategic pivot

Reference: strategic fulcrum

Example 3

ChatGPT: War of Attrition

Reference: protracted war

In Example 1, the term “Beiyang Junfa” is a historical and cultural term in China. ChatGPT’s translation is a direct one, focusing too much on literal correspondence, which fails to capture the deeper meaning behind the term. As a result, Western readers may not fully understand the connotations of the term. To avoid such situations, translators can either refine the translation in the post-translation phase by providing an indirect interpretation of the implied meaning or pre-edit the original text during the pre-translation phase to supplement the core information.

Furthermore, although ChatGPT has strong logical reasoning and internet search capabilities, this large language model was developed by OpenAI, an American company. As such, Chinese content makes up a smaller portion of its pre-training data, and its search ability for Chinese domestic websites is relatively weak. Consequently, it may not accurately search for and translate certain war-related terms in Chinese history and culture, such as “strategic fulcrum” in Example 2 or “protracted war” in Example 3.

It is evident that, in addition to effectively utilizing search engines to enhance information retrieval capabilities, providing a dedicated terminology database during the AI translation process plays a crucial role in improving translation quality. For instance, during the pre-editing phase, specific translation rules can be established for key terms; alternatively, in the post-editing phase, AI-translated terms can be further refined by explaining their underlying meanings or selecting more appropriate term variants to enhance the readability of specialized texts.

4.1.2. Mistranslations

Due to limitations in training models, AI translation engines are prone to mistranslations that lead to information mismatches between the source text and the translation at lexical, syntactic, and discourse levels. In the corpus used for this study, such errors account for approximately 50% of the total.

Example 4

ChatGPT: Wuxiang Drum Opera

Reference: Wuxiang Dagou Storytelling

Example 5

ChatGPT: the Chinese Civil War

Reference: the War of Liberation

Example 6

ChatGPT: Japanese Imperialism

Reference: the Japanese imperialists

Example 7

ChatGPT: Local Resistance

Reference: Regional War of Resistance against Japanese Aggression

Example 8

ChatGPT: against Japanese resistance

Reference: against Japanese aggression

Example 9

ChatGPT: Commemorating the revolutionary martyrs and inheriting the revolutionary spirit

Reference: Pay tribute to the revolutionary martyrs and passing on the traditions of revolution

In Example 4, “Wuxiang Gushu” is officially translated as “Wuxiang Dagū Storytelling.” It is listed as a second batch of provincial intangible cultural heritage in Shanxi Province and is a unique form of local art in the region, where performers drum while singing a play, with the script telling local stories. Therefore, it has been translated as “Wuxiang Dagū Storytelling.” However, ChatGPT, due to its limited understanding of Chinese culture, translated it simply as “opera,” which is a typical mistranslation. In Example 5, “Jiefang Zhanzheng” is officially translated as “the War of Liberation,” referring to the great war in which the Chinese people fought for their liberation and national independence. However, due to its political bias and misunderstanding of Chinese history, ChatGPT translated it as the “Chinese Civil War,” which is also a typical mistranslation. In Example 6, “Ribēn Diguozhuyi” refers to Japan’s imperialist aggression, but ChatGPT, lacking understanding of the term’s deeper meaning, translated it as “imperialism.” In Example 7, “Jūbù Kāngzhàn” refers to part of the war in which China resisted Japanese invaders. ChatGPT translated it literally, which could lead to misunderstandings among readers.

In Example 9, ChatGPT’s translation, using “commemorating,” is highly appropriate. It accurately conveys the reverent and memorial tone of “Mianhuai.” Compared with “remembering” or even “cherish the memory,” the word “commemorating” evokes a more solemn, formal tone, making it particularly fitting for contexts like “Mianhuai Gémíng Xiánlì.” It captures both the honor and ceremony intended in the original, which is why this version received the highest evaluation. Compared to the official translation “Pay tribute to the revolutionary martyrs and pass on the traditions of revolution”, the phrase “pay tribute to” is used to show respect, admiration, or gratitude for someone or something, often publicly. It is in an emotional, respectful, and sometimes personal tone. The word “commemorate” is used to remember and honor a person or event, especially with a ceremony, monument, or official observance. It’s often used with events, holidays, or historical remembrance. Therefore, the word is inappropriate here. ChatGPT cannot understand the deeper meaning of the phrase “Mianhuai,” and mistranslates it.

This type of error highlights the need for translators to thoroughly understand the cultural and historical context of China in the pre-translation phase, carefully considering the deeper meaning of the original text. This approach helps improve the quality of AI-generated translations and reduces the workload in post-translation editing.

4.2. Fluency dimension

In the MQM quality assessment framework, “fluency” refers to aspects of the translation that are closely related to the form and presentation of the text, rather than its meaning. It encompasses three major categories: content, conventions, and readability. The content-related dimension includes factors such as register, adherence to style guides, consistency, and ambiguity. The conventions category covers elements such as spelling, typography, grammar, and regional linguistic variations.

4.2.1. Fluency of translation

Although the translations of ChatGPT are generally capable of rearranging clause structures to highlight implicit logical relationships and avoid rigid, literal renderings caused by “linear translation,” the paratactic nature of Chinese, particularly its use of flowing sentence structures composed of layered coordinate clauses, often poses challenges to fluency. As a result, the translated output may suffer from reduced naturalness and coherence in the target language.

Example 10

ChatGPT: Wangjiayu Village was the location of the headquarters of the Eighth Route Army during the War of Resistance Against Japan. Over 70 years ago, the older generation of Chinese Communist Party revolutionaries

lived and fought here for an extended period, leading the guerrilla warfare in various anti-Japanese bases across North China. Today, it has become an important red tourism destination in Shanxi Province.

Reference: Home to the former headquarters of the Eighth Route Army, a major military force led by the CPC who fought the Japanese invaders more than 70 years ago, Wangjiayu is an important red tourism destination in Shanxi province.

Ellipsis of redundant elements is a common technique in Chinese-to-English translation to avoid Chinglish and enhance the readability of the translated text. However, due to the limitations of AI translation engines, the issue of repetition in the English translation is particularly prominent. In Example 10, in the translation provided by ChatGPT, ‘Wangjiayu Village’ is repeated twice, while the official translation only mentions it once. This does not align with the English language’s preference for conciseness. Repetition in translations remains a significant issue that current AI translation engines struggle to avoid. Translating ‘Suozaidi’ as ‘the location of’ is also redundant. The official translation is concise and clear, whereas the ChatGPT translation is more verbose and complex.

Overall, one significant error type in current AI translation engines, such as ChatGPT, is their inability to effectively use lexical cohesion beyond pronouns to link discourse and enhance readability. To address this issue, it is necessary to employ superordinates, synonyms, near-synonyms, and general terms to connect the text, avoiding repetition and achieving a more elegant choice of words.

4.2.2. Grammar

Due to the differences in sentence structures between Chinese and English, when there are clear connectors between clauses in the Chinese text, AI translation can most effectively preserve the internal logic (although occasional issues such as the misuse or confusion of connectors may still occur). However, when there are no clear connectors in the original text, the error rate in the translation increases significantly.

Participles are widely used in specialized texts due to their more concise nature compared to clauses. However, when multiple participles are used together, the sentence becomes loose, with unclear information hierarchy and a stacking effect, which goes against English language expression habits. This kind of error is often influenced by the flowing sentence structure of Chinese. The corresponding preventive measures mainly include pre-editing the original text, adding appropriate Chinese conjunctions, merging short clauses, or restructuring sentences. These strategies can help reduce the error rate in AI translation and improve translation output efficiency.

The usage of tense is also a major issue in AI translation. Since ChatGPT sometimes fails to accurately grasp the underlying meaning of the text, it may misuse verb tenses. For example, in Example 11, the official translation employs the present continuous tense to indicate an ongoing action, while ChatGPT uses the present perfect tense instead — a clear instance of tense misuse. AI translation cannot truly interpret context, and it often makes errors in sentences involving mixed tenses or requiring inference of the subject’s intent. The present continuous tense emphasizes actions that are currently in progress, while the present perfect tense (has done) highlights actions that have been completed but are still relevant to the present. The semantic distinction between the two is clear, and misuse can lead to a deviation in meaning. This sentence emphasizes that the Communist Party of China is currently leading the Chinese people toward new goals, rather than having already achieved them. Therefore, ChatGPT’s translation contains a grammatical error in its use of tense.

Example 11

ChatGPT: In the past century, the Communist Party of China has delivered an outstanding answer to the

people and to history. Now, the Communist Party of China, united with the Chinese people, has embarked on a new journey toward achieving the second centenary goal.

Reference: Over the past century, the Communist Party of China has secured extraordinary historical achievements on behalf of the people. Today, it is rallying and leading the Chinese people on a new journey toward realizing the second centenary goal.

Example 12

ChatGPT: However, just as the vanguard of the Anti-Japanese Army was about to occupy the Tongpu Railway and actively prepare to move eastward into Hebei to engage directly with Japanese imperialism, Chiang Kai-shek sent more than ten divisions into Shanxi, cooperating with Yan Xishan to block the Red Army's route to resist Japan. He also ordered Zhang Xueliang, Yang Hucheng, and the Shaanxi-Ningxia forces to advance into the Shaanxi-Gansu Soviet area, thereby disrupting our anti-Japanese rear.

Reference: But when it occupied the Tatung-Puchow Railway and was energetically preparing to drive eastward into Hebei to engage the Japanese imperialists directly, Jiang Jieshi sent more than ten divisions into Shanxi and co-operated with Yan Xishan in barring its advance against the Japanese. He also ordered the troops under Zhang Xueliang and Yang Hucheng, as well as the troops in northern Shensi, to march on the Shanxi-Gansu Red area to harass our anti-Japanese rear.

Conjunctions, which function as function words linking words, phrases, or clauses, can generally be categorized into coordinating and subordinating conjunctions. Among these, coordinating conjunctions account for the highest frequency of errors in AI translation. In the data examined in this study, translations of ChatGPT most frequently made mistakes with conjunctions such as “and”, “together with,” and “as well as.” As seen in Example 12, the use of ‘and’ in ChatGPT’s translation is a direct translation of the Chinese word “Bing.” However, from the perspective of English grammar, when listing more than two coordinated elements, the first and second items should be separated by commas rather than connected by conjunctions. Moreover, the conjunction ‘as well as’ places emphasis on the preceding element, which distorts the meaning of the original text. In Example 8, the translation error is directly related to the lack of precision in the Chinese source text. It is recommended that translators pre-edit the source text for clarity and also develop a solid understanding of function words to improve post-editing efficiency and produce high-quality translations.

5. Conclusion

This study conducts an empirical analysis of the performance of the Large Language Model ChatGPT in Chinese-to-English translation, using a self-compiled mini-corpus of specialized texts. The results indicate that ChatGPT can meet the basic translation needs for informational texts, but it still struggles with complex sentences. Translation errors mainly occur in two areas: “accuracy” and “fluency.” Typical errors are manifested in three aspects: inappropriate terminology, inaccurate information, and lack of fluency in the translation.

Indeed, while the proliferation of artificial intelligence continues to drive the emergence of new translation technologies in the language services industry, “no machine translation system is currently capable of simultaneously reproducing the conceptual, discourse, and interpersonal meanings of a source text.” Therefore, mastering translation technologies—especially the “AI translation + post-editing” model—and understanding how AI translation works can help translators quickly identify common errors. Moreover, by combining AI translation with the MQM quality assessment framework, translators can utilize the model’s definitions and classifications of translation errors as a reference tool for targeted editing and refined translation output.