

AI-Empowered and Ideologically Guided: Teaching Mode Reconstruction and Practice for Computer Networks

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Abstract: Against the backdrop of in-depth advancement in the digital transformation of education and full implementation of the fundamental task of fostering virtue through education, the Computer Network course, as a core foundational course for computer and electronic information majors in colleges and universities, faces three prominent and well-defined pain points: the rigid and disconnected integration of ideological and political elements with professional teaching; the single and rigid teaching evaluation system; and the weak digital education competence of teachers. Taking the Computer Network course at Anhui Xinhua University as the practical carrier and proceeding from the talent cultivation orientation of local application-oriented universities, this paper constructs a "two-wheel drive" teaching mode featuring "ideological and political guidance+AI empowerment" in a natural and appropriate manner, and systematically reconstructs the whole-process teaching closed loop of "pre-class-in-class-after-class" as well as the dual-dimensional intelligent evaluation system covering knowledge competence and value literacy. Verified by one semester of teaching practice, the proposed mode effectively solves the long-standing problem of "two separate skins" between ideological and political education and professional teaching. Students have achieved higher academic scores, stronger learning initiative and tangible improvement in ideological and political literacy, while teachers have substantially enhanced their digital teaching competence and ideological and political education ability. As a result, a replicable and scalable teaching reform paradigm for computer-related courses has been formed, which is of great demonstrative value for the digital transformation and ideological and political education of science and engineering courses in local application-oriented universities.

Keywords: Curriculum Ideology and Politics; AI Empowerment; Computer Network; Teaching Mode Reconstruction.

1. Introduction

Since 2025, nine ministries including the Ministry of Education and the State Council have successively issued relevant policy documents, clearly proposing to promote the in-depth coordinated development of artificial intelligence with education, teaching and ideological and political education, and accelerate the process of educational digital transformation[1][2]. Among them, the Outline for Building a Leading Country in Education (2024–2035) explicitly identifies artificial intelligence as the core driving force for educational transformation, emphasizes strengthening value guidance and promoting the in-depth integration of ideological and political work with information technology[3]. It has drawn a clear strategic direction for the teaching reform of "value guidance + technological empowerment" in science and engineering courses, and also provided solid policy compliance for the innovation of teaching mode of the Computer Network course.

As the most typical and important foundational course for computer and electronic information majors, the Computer Network course has a natural and close connection between its knowledge system and the national cyber power strategy as well as the construction of the national digital security system. Therefore, the course should not only undertake the professional education responsibility of cultivating students' professional technical ability, innovative thinking and engineering practice ability, but also bear the mission of ideological and political education including cyberspace sovereignty education, scientific and technological ethics

education and craftsman spirit cultivation.

However, it is undeniable that the traditional teaching mode has long been unable to well meet the needs of cultivating high-quality compound digital talents in the new era. Problems such as rigid integration of ideological and political elements, abstract and difficult content, single evaluation system and teachers' competence to be improved have become increasingly prominent[4]. For this reason, taking the in-depth synergy between ideological and political guidance and AI empowerment as the core proposition, this paper systematically carries out research on the reconstruction of the teaching mode of the Computer Network course. Its ultimate goal is to solve the existing teaching pain points and provide practical and feasible solutions that can be truly implemented and promoted for the ideological and political education of science and engineering courses in local application-oriented universities.

2. Research Status and Core Issues

(1) Domestic Research Status

Curriculum ideology and politics and AI-empowered education have become two distinct and important directions in the teaching reform of higher education, both of which have solid and mature research results[5][6]. In terms of curriculum ideology and politics, domestic universities have completely got rid of the old misunderstanding of preachy and formal integration. Nowadays, more attention is paid to systematically and naturally excavating ideological and political elements and designing teaching schemes based on disciplinary logic and course characteristics[7]. In terms of

AI-empowered education,artificial intelligence technology has been well penetrated into pre-class preview,classroom teaching,after-class expansion and other links,effectively improving teaching efficiency and greatly enhancing students'learning experience.

Nevertheless,it is undeniable that there are still several noteworthy problems in the research on the integrated application of the two,which cannot directly meet the practical needs of teaching reform of the Computer Network course in local application-oriented universities:

First,most integration methods remain at the level of"tool superposition",and an education system that truly reflects the synergy between ideological and political guidance and AI empowerment has not been established[8].

Second,existing practices mostly target a single teaching link,lacking a closed-loop teaching mode covering the whole process.

Third,current special studies mostly focus on high-level universities,lacking practical paradigms suitable for the talent cultivation orientation of application-oriented universities[9].

Fourth,the integration lacks pertinence and is not fully combined with the professional characteristics of the Computer Network course,resulting in unsatisfactory integration effects.

(2) Summary of Core Issues

Based on teaching practice,three major problems consistent with the project application are summarized naturally and appropriately.

First,restricted by the abstract and difficult course content,students generally show low learning participation,and there is a lack of effective and targeted carriers for the organic integration of ideological and political elements.The Computer Network course features highly abstract,systematic and logically rigorous knowledge system,while maintaining close and dynamic connection with engineering practice.Its curriculum knowledge is updated rapidly in line with the iterative development of Internet industry technologies,with new network protocols, intelligent network architectures and emerging cyber technologies constantly emerging,which greatly increases the learning difficulty for undergraduate students.Affected by the obscure theoretical content and fast knowledge iteration,many students gradually generate fear of difficulties and fall into passive learning status,resulting in poor learning initiative and unsatisfactory classroom participation.More importantly,the current ideological and political integration lacks scientific,systematic and curriculum-oriented design.Most selected ideological cases are disjointed from core professional knowledge points,unable to achieve effective docking with course teaching.Meanwhile,traditional practical teaching only focuses on the standardization and accuracy of students'technical operation skills,ignoring the implicit infiltration of network security responsibility,cyber governance awareness and scientific and technological ethics.Such rigid teaching mode fails to build an inherent connection between professional skill learning and value shaping,making moral education superficial and ineffective.

Second,the traditional teaching evaluation system is single and rigid,lacking whole-process dynamic tracking and timely teaching feedback mechanisms[10].Traditional course evaluation overly relies on summative assessment methods including final closed-book examinations and phased written assignments,while attaching insufficient importance to diversified process indicators,such as pre-class preview

completion effect,in-class interactive performance,after-class practical operation process and daily ideological and political literacy manifestation.Such a single evaluation dimension cannot comprehensively and objectively assess students'comprehensive professional ability and core literacy.In addition,the collection of daily teaching process data is fragmented and unsystematic,failing to form continuous learning portraits of students.Teachers cannot accurately and timely identify students'knowledge blind spots, methodological misunderstandings and literacy deficiencies. Without reliable data support for targeted teaching adjustment, the complete"evaluation-feedback-teaching optimization"closed loop cannot be formed,which greatly limits the continuous improvement of overall teaching quality.

Third, teachers'insufficient ability in ideological and political mining and AI technology application hinders the in-depth implementation of teaching reform.As the core implementers of curriculum ideology and politics and AI-empowered teaching,teachers'comprehensive literacy directly determines the reform effect.Nevertheless,most teachers currently excavate ideological and political elements relying only on personal teaching experience and scattered reference materials,resulting in fragmented and unnatural integration with professional knowledge.Moreover,teachers only apply basic functions of AI teaching tools such as homework correction and simple learning situation statistics,and fail to integrate AI technology into the whole teaching process to solve practical teaching pain points.Restricted by these competency deficiencies,most teaching reform schemes only stay at the theoretical design stage and cannot achieve tangible practical effects.

3. Research Design and Implementation Path

(1)Research Objectives

With a clear grasp of the core talent cultivation orientation of "valuing practice,strengthening application and cultivating comprehensive literacy" in local application-oriented universities,this paper takes the prominent teaching pain points of the Computer Network course as the key breakthrough point. By deeply integrating systematic ideological and political guidance with intelligent AI teaching empowerment,this study puts forward three structured, targeted and practical research objectives. First,it aims to reconstruct a innovative whole-process teaching mode featuring "AI-enabled precise preview before class-collaborative interactive teaching in class-intelligent growth tracking after class". This optimized closed-loop mode effectively addresses the long-standing teaching dilemma of disjointed professional teaching and ideological cultivation, fundamentally solving the "two separate skins" problem in traditional curriculum education. Second,the research intends to construct a scientific dual-dimensional intelligent evaluation system that covers both professional knowledge competence and comprehensive value literacy.By organically combining dynamic process evaluation and standardized summative evaluation,the system realizes quantitative,comprehensive and objective assessment of teaching and learning effects,making educational outcomes measurable and traceable.Third,this study strives to achieve dual improvement of teaching and learning quality.It promotes the coordinated development of students'

professional practical ability and ideological and political literacy,as well as the simultaneous upgrading of teachers'digital teaching competence and curriculum ideological integration capability.Ultimately,it forms a stable,replicable and scalable teaching reform paradigm for computer-related courses that fully adapts to the schooling and talent cultivation characteristics of application-oriented universities.

(2)Research Methods

To reflect scientificity,practicality and effectiveness,four research methods are adopted naturally and appropriately,forming a clear and rigorous research path of"theoretical research–practical exploration–verification and optimization":

First,the literature research method:systematically sort out policy documents and academic achievements on educational digitalization,curriculum ideology and politics,and AI-empowered education to clarify the theoretical basis.

Second,the action research method:organize the professional teaching team to improve the teaching mode cyclically following the logic of"design–practice–reflection–optimization–re-practice".

Third,the comparative experiment method:take two parallel classes as research samples,carry out teaching with the new mode and the traditional mode respectively,and directly and fully test the effectiveness of the new mode.

Fourth,the questionnaire survey and interview method:collect feedback from teachers and students by questionnaires and interviews at the end of the semester,and

optimize the teaching mode objectively and reasonably based on the feedback.

4. Reconstruction of Teaching Mode with Synergy Between Ideological and Political Guidance and AI Empowerment

Proceeding from the professional characteristics of the Computer Network course and the actual needs of applied talent cultivation,this paper naturally and hierarchically proposes an integrated teaching mode of"one core,two-wheel drive,three stages and four-dimensional support":

•"One core"refers to the fundamental task of fostering virtue through education,which is implemented throughout the whole process.

•"Two-wheel drive"takes the value core of ideological and political guidance and the technical support of AI empowerment as two wheels,driving each other and complementing each other.

•"Three stages"refer to the whole-process teaching closed loop of pre-class,in-class and after-class,with clear logic and close connection.

•"Four-dimensional support"refers to the organic integration of systematic teaching resources,intelligent teaching tools,scientific evaluation system and professional teaching team,which truly provides strong support for the implementation of the teaching mode.

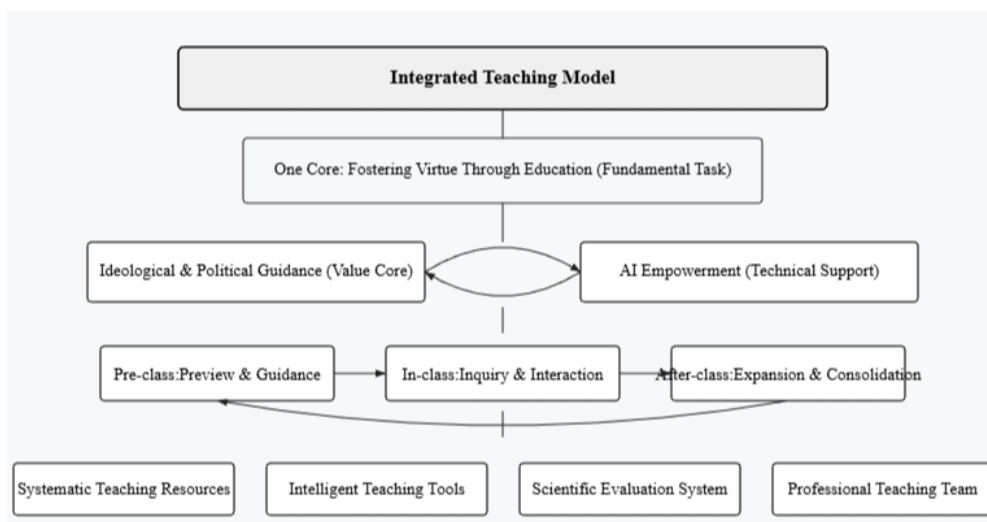


Figure 1. Architecture of Integrated Teaching Mode for Computer Network Course

(1) Pre-class: AI-enabled Precise Preview and Pre-penetration of Ideological and Political Elements

The pre-class link follows the basic idea of"AI-enabled precise preview+pre-penetration of ideological and political elements",which naturally and appropriately makes solid preparations for in-class teaching.

The teaching team first systematically and hierarchically sorts out 36 knowledge points in all chapters of the course,and then combines the national cyber power strategy and industry ethical requirements to actively and clearly construct a precise mapping system of"knowledge points–ideological and political elements–teaching scenarios".For example,the TCP/IP protocol is naturally bound with craftsman spirit,and network security is bound with national sovereignty,forming a complete and logical ideological and political mapping

matrix.

Then,with the help of AI tools such as Rain Classroom and educational large language models,personalized preview packages are automatically generated based on students'academic data,and differentiated learning resources are pushed to students with different foundations.At the same time,AI tools automatically collect preview data and generate real-time learning situation reports at both class and individual levels,so as to accurately identify knowledge blind spots and ideological and political interest points,and naturally formulate precise strategies for in-class teaching.

(2)In-class:Immersive Interactive Teaching with Synergy of Ideological and Political Education and AI

The in-class link takes"collaborative interaction between ideological and political education and AI"as the clear main

line, which naturally and appropriately solves the two pain points of abstract content and rigid integration of ideological and political elements.

First, the AI virtual simulation platform transforms abstract knowledge points such as TCP three-way handshake and routing protocols into interactive and situational virtual scenarios. Therefore, students can learn through practical operation and understand principles through hands-on practice, which greatly reduces the difficulty of learning.

More importantly, ideological and political elements are naturally and effectively integrated into each knowledge point. When explaining domestic network equipment, the concept of scientific and technological self-reliance and self-improvement is infiltrated; in network attack and defense experiments, discussions on professional ethics and laws and regulations are embedded, without any rigid preaching.

In perfect coordination with this, the AI real-time learning situation feedback system collects data such as classroom interaction and in-class quizzes in real time, based on which teachers dynamically adjust teaching rhythm and ideological and political guidance methods.

(3) After-class: AI Intelligent Tracking and Continuous Cultivation of Ideological and Political Literacy

The after-class teaching link sets "AI intelligent tracking+continuous cultivation of ideological and political literacy" as the core development goal, which complements the in-class teaching and pre-class preview links, and finally forms a complete, efficient and systematic whole-process teaching closed loop. Supported by the big data learning analysis technology of artificial intelligence, this link breaks through the limitations of traditional after-class teaching that relies on unified assignments and lacks targeted guidance. Based on the multidimensional learning situation data efficiently collected and analyzed before and during class, the AI teaching system can accurately identify individual students' knowledge weaknesses, learning gaps and ability deficiencies. According to differentiated learning demands, it intelligently pushes personalized knowledge consolidation exercises and hierarchical professional expansion resources for different students, realizing precise and customized "thousand-person thousand-face" whole-process learning support.

Meanwhile, this study designs comprehensive practical tasks with deep integration of professional skills and ideological and political education, represented by the local area network construction practice based on domestic independent research and development equipment. Such practical tasks can not only effectively inspect students' professional operation and practical problem-solving skills, but also objectively quantify and evaluate their key ideological and political literacy including normative awareness, industry compliance and collaborative teamwork spirit. More notably, the AI platform continuously tracks and records students' full-semester learning behavioral data, and automatically generates intuitive visual reports covering each student's growth trajectory in professional competence and ideological and political performance. This data-driven teaching mechanism ultimately realizes the scientific two-way closed-loop optimization of precise teaching adjustment and active student learning improvement.

5. Construction of Dual-dimensional Intelligent Evaluation System of Knowledge Competence and Value Literacy

In view of the clear shortcomings of traditional teaching evaluation, this paper naturally and appropriately proposes a dual-dimensional intelligent evaluation system covering knowledge competence and value literacy. Combined with AI technology for collection, analysis and optimization of whole-process data, it can effectively ensure the scientificity and comprehensiveness of evaluation, and well implement the concept of "promoting teaching and learning through evaluation".

(1) Design of Dual-dimensional Evaluation Index System

This student comprehensive evaluation system is scientifically constructed following the core principles of scientificity, comprehensiveness and operability, aiming to overcome the one-sidedness of traditional single-assessment methods. The system adopts a dual dimensional evaluation framework with reasonably distributed indicator weights, covering the whole learning process and comprehensive literacy development. It sets two first-level evaluation indicators in total, among which process evaluation accounts for 60% of the overall score and summative evaluation accounts for 40%, highlighting the dominant position of continuous learning performance in teaching assessment.

In terms of specific indicator settings, the knowledge competence dimension occupies a core weight of 65% and consists of three detailed second-level indicators, including mastery of professional theoretical knowledge, flexible application of practical operational skills, and progressive improvement of innovative thinking and ability. This dimension can comprehensively and systematically assess students' professional learning effectiveness and practical application capabilities. Meanwhile, the value literacy dimension, with a weight of 35%, contains three second-level indicators covering ideological and political cognitive level, daily professional literacy performance, as well as teamwork awareness and sense of responsibility. It effectively makes up for the long-term deficiency of quantitative assessment of ideological and political literacy in traditional teaching evaluation, realizing a comprehensive, objective and all-round evaluation of students' professional competence and comprehensive literacy.

(2) Implementation of Whole-process Evaluation Empowered by AI

Supported by AI teaching tools and big data analysis technology, evaluation data are collected systematically and hierarchically: preview data are collected before class; data such as classroom interaction and practical operation performance are collected during class; data such as homework and practical tasks are collected after class.

Then, the AI system standardizes all the data, thus naturally and appropriately generating three-level visual evaluation reports for individual students, classes and teaching units. More importantly, the AI system actively and timely pushes teaching optimization suggestions and students' learning improvement plans based on the data, truly forming a virtuous closed loop of "evaluation-feedback-optimization", and naturally achieving the goal of "promoting teaching and learning through evaluation".

6. Practical Effects

Based on the solid, hierarchical and systematic summary of the innovative teaching mode accumulated through one semester of controlled comparative teaching practice, this paper comprehensively and objectively presents the practical application achievements of the new teaching mode from three core dimensions covering student development, educational value and teacher growth.

First, students' academic performance and autonomous learning enthusiasm have achieved remarkable and dual improvement. Statistical data of final assessment shows that the average score of the experimental class adopting the new teaching mode reaches 82.3, which is 8.8 points higher than that of the traditional control class. In terms of daily learning status, the completion rates of pre-class preview tasks and after-class extended homework in the experimental class both exceed 97%. This obvious gap with the control class fully proves that the optimized teaching mode can effectively stimulate students' learning initiative and consolidate their professional knowledge foundation.

Second, the integrated ideological and political education effect achieves outstanding results with high student recognition. A targeted student questionnaire survey indicates that 95.6% of students in the experimental class affirm the natural and organic integration of ideological and political elements and professional curriculum knowledge, without rigid and forced indoctrination. Meanwhile, 93.3% of students report significant enhancement in their cognition of China's national cyber power strategy and firm confidence in dedicating to national development through science and technology, realizing the fundamental goal of fostering virtue through education.

Third, the comprehensive professional teaching ability of teachers has been effectively upgraded. All teachers participating in the teaching practice have fully and proficiently mastered the operation and application skills of AI auxiliary teaching tools. They are able to design logical, targeted and humanistic ideological and political teaching schemes in combination with curriculum characteristics, which greatly optimizes teaching design and classroom delivery, and substantially improves their overall teaching professionalism.

7. Conclusion

This study focuses on the deep integration of ideological and political education and AI-enabled teaching in computer engineering courses of local application-oriented universities. On the basis of analyzing the common pain points of traditional teaching and existing related studies, this research constructs a whole-process closed-loop teaching paradigm centered on the "ideological and political guidance + AI empowerment" concept, and verifies its practical effect through one-semester comparative teaching practice. The core research conclusions, existing limitations and future prospects are summarized as follows.

First, this study has formed three-dimensional innovative achievements with outstanding practical application value. In terms of conceptual innovation, this research creatively puts forward the two-wheel drive education concept of "ideological and political guidance + AI empowerment", which effectively solves the widespread industry dilemma of "two separate skins" — the disconnection and mutual independence between ideological and political education

and professional technology teaching. It truly realizes the organic integration and coordinated development of value guidance, professional knowledge imparting and practical ability cultivation in engineering teaching, and provides a new ideological framework for curriculum ideological and political reform in engineering majors. In terms of model innovation, this research reconstructs the whole-process closed-loop teaching mode covering "pre-class preview– in-class teaching–after-class improvement". Taking advanced AI teaching technology as the core bridge, the mode fundamentally breaks through two long-standing teaching difficulties: the abstract and obscure theoretical content of courses, and the rigid and superficial integration of curriculum ideological and political elements, and significantly improves the depth and naturalness of ideological and political integration as well as the acceptability of theoretical knowledge. In terms of application innovation, this research forms a complete, replicable and transplantable teaching paradigm suitable for large-scale promotion in local application-oriented universities. The paradigm has a low implementation threshold, which does not rely on high-end experimental equipment or high-level professional teaching teams, and can be efficiently implemented only with conventional universal AI tools. It can be easily migrated to similar computer engineering courses, and has strong popularization value and practical application potential.

Second, the current teaching practice still has three notable deficiencies, which define the direction for subsequent optimization. From the feedback of one-semester comparative teaching practice, the stock of supporting teaching resources is still insufficient: the existing AI teaching resources and ideological and political case databases are relatively limited, and high-quality targeted teaching materials adapted to cutting-edge network technologies such as emerging communication protocols and intelligent network architecture are in shortage. In terms of student learning, a small number of students show improper dependence on AI tools; they over-rely on AI to complete assignments and analyze professional problems, which gradually weakens their independent logical reasoning ability and hands-on fault diagnosis ability. In terms of teaching team, most teachers only master basic AI-assisted teaching functions, and lack proficiency in deep-level AI teaching application and seamless integration of curriculum ideological and political elements, so systematic and standardized professional training is urgently needed.

Finally, this study clarifies the optimization path and development prospect of follow-up teaching reform. In the next stage, the research team will continuously track the frontier progress of industrial technology and national cyberspace governance policies, enrich and classify diversified and dynamically updatable teaching resource reserves. In teaching design, targeted guided independent exploration tasks will be added to restrain students' blind dependence on AI, and strengthen their autonomous thinking ability and practical problem-solving skills. For the teaching team, systematic professional training will be carried out to improve teachers' in-depth AI application ability and curriculum ideological and political integration literacy. On this basis, this research will further iterate and optimize the whole teaching model, build a multi-dimensional teaching resource library, gradually popularize the framework to more engineering courses, and carry out cross-university

collaborative practice, so as to provide practical support and reference for promoting the digital transformation of education in local application-oriented universities.

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