Exploration and Practice of AIGC-Enabled Individualized Teaching Models for Interdisciplinary Clusters of Information Technology Courses

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Abstract. Aiming at the pain points of poor knowledge articulation and difficulty in meeting personalized needs in inter-professional group teaching, this study explores the personalized teaching mode of information technology courses empowered by AIGC technology. Based on the theories of constructivism and mastery learning, a four-dimensional framework of "demand analysis-content generation-path design-collaborative mechanism" is constructed.Through multi-source data collection to analyze students' professional background and cognitive characteristics, AIGC is used to generate teaching resources with a high degree of adaptability, establish a mechanism for inter-professional collaboration, and achieve interdisciplinary knowledge integration and innovation through a blockchain resource sharing platform, a joint teaching and research community, and a smart project collaboration model. The study shows that the model significantly improves students' interdisciplinary knowledge integration and project completion, effectively reduces the learning difficulty of complex technologies, and promotes educational equity.It provides a new technological path for information technology curriculum reform and promotes the development of education in the direction of precision, personalization and collaboration, which is of value for promotion.

Keywords: Aigc technology; Information technology courses; Interprofessional cluster teaching; Individualized instruction

1 Introduction

In today's rapid development of artificial intelligence technology, AIGC technology is gradually subverting the boundaries of the traditional education model, providing unprecedented possibilities for personalized teaching [1].As a core general education course of inter-professional group in higher vocational colleges and universities, the information technology course has long been facing the dilemma of diverse students' professional backgrounds, significant differentiation of learning needs, and difficulty in accurate adaptation of traditional teaching content [2].In order to solve this problem, this research project focuses on the "Exploration and Practice of AIGC-enabled Personal-

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ized Teaching Mode for Interdisciplinary Groups of Information Technology Courses", which aims to build a personalized learning ecology that meets the needs of inter-disciplinary groups through the intelligent generation and dynamic optimization of teaching content driven by artificial intelligence technology. The core objective of this study is to break through the traditional "one-size-fits-all" teaching paradigm and realize three innovations based on AIGC technology (Fig. 1). First, based on students' professional characteristics, learning progress and interest preferences, it automatically generates accurately matched personalized teaching content to make knowledge delivery more targeted; second, it builds an intelligent learning path recommendation system to dynamically adjust the learning plan based on real-time learning data, forming "one thousand people, one thousand faces" teaching support; finally, through multiple rounds of Finally, through multiple rounds of teaching experiments and effect evaluation, iteratively optimize the content generation algorithm and teaching strategy to form a generalizable personalized teaching model for inter-professional groups.

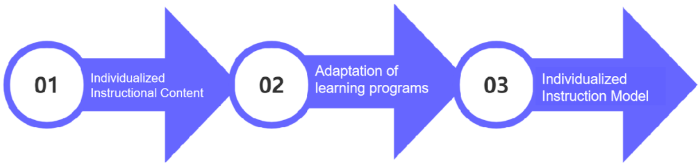

Fig. 1. Three AIGC Innovations

2 Current Status of Inter-Professional Cluster Teaching

Currently, teaching across professional clusters faces many challenges in information technology programs. As students come from different professional backgrounds, such as big data, digital media, intelligent construction, etc., there are significant differences in their knowledge base and cognitive structure, which makes it difficult for traditional teaching content to meet the needs of all students. This "one-size-fits-all" teaching model often ignores the individual differences of students, making some students lose interest because the content is too simple, while others have difficulty in keeping up with the progress because of the difficulty[3]. Poor knowledge articulation is a major challenge in interprofessional cluster teaching (Fig. 2). There is a knowledge system disconnect between different majors, e.g., Big Data majors may have in-depth knowledge of algorithms and data processing, but little knowledge of visual content generation techniques in the digital media field. This knowledge divide not only affects students' ability to integrate interdisciplinary knowledge, but also limits their collaborative efficiency in complex projects.

In terms of personalized needs satisfaction, the existing teaching model appears to be inadequate. Teachers are difficult to conduct accurate teaching for each student's professional background, learning progress and interest preferences, resulting in some students not being able to obtain learning support that matches their needs[4]. For example, students majoring in intelligent construction may pay more attention to engineering informatization cases, while the traditional teaching content often lacks such highly targeted practical projects. In addition, cross-institutional collaboration and resource sharing also face challenges. Although different institutions cooperate on IT courses, teaching resources are scattered and of different standards, making it difficult to realize efficient sharing. This limits the overall improvement of teaching quality and affects the equity of students' access to quality education resources.

In response to the above situation, AIGC technology shows great potential for application. By intelligently analyzing student data, AIGC can automatically generate personalized teaching content and provide highly adapted learning materials for students of different majors. At the same time, based on the real-time feedback of students' learning behavior, AIGC can also dynamically adjust the learning path to ensure that each student can progress along the most suitable trajectory. This technology-driven personalized teaching model is expected to break the limitations of traditional teaching and bring revolutionary changes to inter-professional group teaching.

Fig. 2. Current status of inter-professional cluster teaching

3 The Theoretical Basis of the Individualized Teaching Model

The construction of personalized teaching mode is rooted in the multi-dimensional theoretical frameworks of constructivist learning theory, mastery learning theory, multiple intelligences theory and taxonomy of educational objectives. Constructivism emphasizes the learner's subjective position in the construction of knowledge, and considers learning to be the process of actively constructing meaning in interaction with the environment. AIGC technology analyzes students' interests and needs intelligently, and provides them with highly adapted learning resources and contexts to support their internalization of knowledge through exploration.

The theory of mastery learning was proposed by Bloom, which advocates that every student can master the learning materials as long as he/she is given sufficient time and personalized support[5]. AIGC-driven personalized teaching system can accurately diagnose students' cognitive bias, dynamically generate compensatory teaching content, and form a closed-loop structure of "Learning-Assessment-Adjustment" through an immediate feedback mechanism to ensure students' solid mastery of core concepts.

The closed-loop structure of "learning-assessment-adjustment" is formed through instant feedback mechanism, which ensures that students can master the core concepts in a solid way. The theory of multiple intelligences reveals the plurality of individual intelligences, and Gardner's definition of logical-mathematical, linguistic, spatial and other types of intelligences are differently distributed in different students. With the help of AIGC technology, this study can customize learning paths for students' intelligence advantages, such as generating 3D visualization cases for students with outstanding spatial intelligence and providing interactive narrative teaching resources for those with outstanding linguistic intelligence, so as to realize intelligence-oriented tailor-made teaching.

The taxonomy of educational goals provides a goal-oriented framework for personalized teaching, and its classification of cognitive domains (at the levels of memorization, comprehension, and application) sets clear standards for AIGC content generation[6]. The system can automatically match teaching materials and assessment methods of different complexity according to students' learning stages, such as pushing project-based learning cases at the "application" level and providing open-ended problem solving tasks at the "creation" level, forming a stepwise competence development support. The above theories together build a framework for personalized teaching[7]. The above theories together build the theoretical cornerstone of personalized teaching, and AIGC technology, as an intelligent engine, is driving these theories from concept to practice, providing strong technical support for the innovation of inter-professional group teaching.

4 AIGC Empowers the Construction of an Individualized Teaching Model for Information Technology Courses Across Professional Clusters

4.1 Requirements Analysis and Content Generation

In the AIGC-enabled personalized teaching model, demand analysis and content generation are the core links in building accurate teaching support. This study adopts a multi-source data fusion analysis strategy to deeply analyze the professional backgrounds, knowledge starting points, learning styles, and interest preferences of inter-professional group students through three-dimensional means such as questionnaire surveys, interview research, and learning behavior data collection[8].

The questionnaire is designed to cover the dimensions of professional relevance, mastery of prerequisite courses, and use habits of technical tools, combining Likert scales and open-ended questions to quantitatively present the cognitive differences of students. The interview session focuses on typical professional groups, such as big data technology professional group students focus on algorithm optimization case requirements, digital media professional students emphasize the ease of use of visual content generation tools, and the smart construction group shows great interest in engineering cases combining BIM technology and IoT. Learning behavior data are collected through the LMS platform, including video viewing hours, forum interaction frequency, programming practice error types, etc., to construct student learning portraits.

Based on the results of the requirement analysis, the AIGC content generation system initiates an intelligent production process. For the explanation of basic concepts, the system automatically adjusts the knowledge presentation according to the professional background: dynamic graphics are pushed to the digital media students to explain the IP address allocation mechanism, and binary coding cases are generated for the intelligent construction group in the engineering informatization scenario. In the case design session, AIGC generates differentiated projects in combination with industry hotspots - big data students analyze smart city traffic flow data, digital media students create a virtual showroom of meta-universe, and smart construction students simulate IoT deployment in smart construction sites. The construction of the exercise library adopts the mechanism of difficulty stratification and dynamic evolution, with basic questions reinforcing knowledge consolidation and advanced questions incorporating cross-disciplinary integration elements, such as requiring big data students to use Python to analyze the user behavior data of the digital media case.

The content generation process is embedded with a quality monitoring mechanism, which detects knowledge accuracy through natural language processing algorithms on one hand, and establishes a feedback channel for students to collect content fitness evaluation on the other. To address the possible ambiguity of terminology in the initial content generation, the system introduces an interdisciplinary expert knowledge base for verification; for dynamically generated programming exercises, automated test scripts are deployed to verify the functional correctness of the code. This closed-loop structure of “demand analysis-content generation-quality monitoring” ensures that AIGC technology can continuously produce personalized learning resources that meet the teaching requirements of inter-professional groups.

4.2 Dynamic Learning Path Design

Dynamic learning path design is the core innovation of AIGC's empowering personalized teaching model, and its essence lies in building a path planning mechanism that can be intelligently adjusted according to students' real-time learning status. This study breaks through the limitations of the traditional linear curriculum and builds a multi-dimensional path model based on knowledge mapping, covering four levels of ability progression ladder, namely, “foundation consolidation-skill advancement-project combat-innovation exploration”.

The path generation algorithm adopts a reinforcement learning framework, with the learner profile as the input layer, including professional background, learning style, knowledge mastery and other feature vectors. The decision network is based on the taxonomy of educational goals to set the reward function, for example, positive incentives are given to students when they complete the tasks at the “application” level, and the path branching is triggered when they break through at the “creation” level. For students majoring in Big Data, the initial path may focus on the progressive learning of Hadoop ecological components; the path for digital media students may focus on After

Effects visual effects; and the path for the intelligent construction group will incorporate the development of composite skills of BIM modeling and IoT integration.

The path optimization mechanism contains a dual-loop feedback structure: the inner loop implements real-time behavioral monitoring, parsing students' programming error logs and lab report texts through AIGC to identify knowledge blind spots; the outer loop performs cycle assessment, using a cognitive diagnostic model to analyze stage-by-stage test data and locate competency shortcomings. When the system detects that students persistently make mistakes in recursive algorithms, it automatically pushes the visual debugging toolkit and inserts supplemental practice modules; if students are found to lack interest in cloud computing security, they are dynamically replaced with engineering cases that combine their specialties-such as generating smart construction site network security protection projects for smart construction students.

Multimodal interaction design enhances path immersion, AI teaching assistants provide 24-hour Q&A based on natural language processing, the virtual lab environment supports digital media students to preview the animation effects generated by AIGC in real time, and the intelligent code completion tool provides context-aware code suggestions for programming learners. This dynamic path design of “algorithm-driven-data feedback-human-computer collaboration” not only realizes the precise matching of learning resource supply, but also helps students break through the nearest development zone and form a personalized ability growth trajectory through continuous path evolution.

4.3 Interprofessional Synergy Mechanisms

Interprofessional collaboration mechanism is the key support for personalized teaching mode to realize resource integration and teaching innovation, and its core lies in the construction of a teaching ecosystem that breaks down professional barriers and promotes multi-dimensional collaboration (Fig. 3). This study proposes a “three-dimensional synergy framework”, which includes three dimensions: resource sharing platform, joint teaching and research mechanism, and project collaboration mode, and maximizes the synergy through the empowerment of AIGC technology[9].

The resource sharing platform adopts blockchain technology to build a distributed resource pool, integrating cross-institutional high-quality course resources, industry case bases, virtual simulation tools and so on. The platform supports intelligent retrieval and recommendation functions. For example, when students carry out IoT project design in the field of intelligent construction, AIGC can automatically push data processing algorithm cases of big data majors and 3D modeling resources of digital media to form a multidisciplinary knowledge supply network. The resource update mechanism introduces the crowdsourcing model, where teachers and industry experts can upload self-produced content, which will be incorporated into the platform after quality checking by AIGC, realizing the continuous evolution of resources.

The joint teaching and research mechanism breaks through the boundaries of traditional subject groups to form an interdisciplinary teaching and research community comprising IT teachers, professional teachers, and industry mentors. AIGC technology assists in teaching and research decision-making, and analyzes students' interdisciplinary course learning logs through natural language processing to generate collaborative teaching and learning improvement reports. For example, when it is found that students majoring in big data lack understanding of engineering application scenarios, it automatically triggers joint course design with smart construction faculty to develop an integrated module on “Engineering Data Analytics”. Regular AIGC-driven teaching and research workshops are held to demonstrate the application of intelligent content generation tools in educational scenarios and enhance teachers' digital literacy.

AIGC generates differentiated project frameworks for each team, such as a digital twin display module for a team of students who specialize in visual design, a real-time analysis subsystem for a team with strong data processing skills, and a digital twin display module for a team of students who specialize in visual design. AIGC generates a differentiated project framework for each team, such as a digital twin display module for student teams that specialize in visual design, and a real-time analysis subsystem for teams with strong data processing capabilities. AIGC also introduces an intelligent evaluation system into the collaboration process, whereby AIGC parses project documents, codes and demonstration videos to generate personalized evaluation reports from the dimensions of professional contribution and effectiveness of collaboration, thus facilitating dynamic optimization of the team and the complementarity of its members' abilities.

This inter-professional collaboration mechanism not only realizes the cross-domain circulation of educational resources, but also forms a closed-loop ecology of “resource sharing, teaching and research innovation, and project practice” through the intelligent matching and dynamic regulation driven by AIGC, providing a systematic solution for the personalized teaching of inter-professional groups.

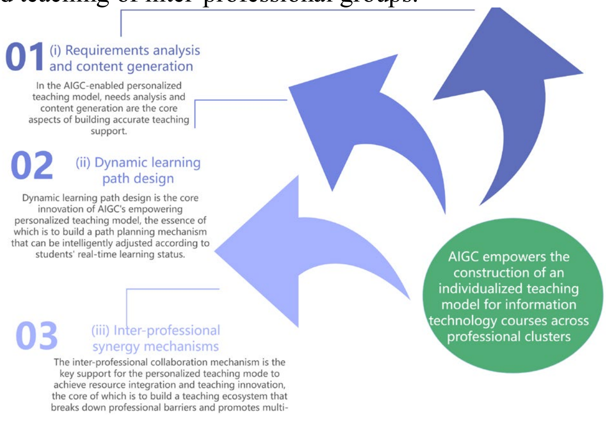

Fig. 3. Construction of personalized teaching mode

4.4 Construction of a Multi-Dimensional Education Goal Assessment System

In order to comprehensively assess the effectiveness of the AIGC-enabled personalized teaching model, it is necessary to break through the traditional single evaluation framework that focuses on knowledge integration and project completion, and to construct a multidimensional assessment system that covers higher-order thinking, collaborative ability, independent learning, digital literacy, and emotional attitude. Based on Bloom's Taxonomy of Educational Objectives and the 21st century core literacy framework, this study proposes the following assessment index design and implementation path[10]:

Assessment of higher order thinking skills.Open-ended tasks are embedded in the dynamic learning path, and students' logical reasoning, hypothesis validation and innovative breakthrough abilities are quantified through the analysis report of their problem solving process generated by AIGC.A double-blind evaluation mechanism is introduced, whereby interdisciplinary faculty and industry experts rate the innovation and feasibility of the project results in multiple dimensions, forming an “innovation index”.

Collaboration and communication skills assessment.Utilizing AIGC to analyze project collaboration traces and generate heat maps of member contributions and team communication efficiency reports.Combine peer rating scales and mentor observation records to quantify task division of labor, conflict resolution, and cross-specialty terminology transfer.

Self-directed learning and metacognitive skills tracking.The frequency of students' learning path selection, resource retrieval behavior and reflection logs are collected through the LMS platform to construct an independent learning index. For example, the frequency of students' active use of AIGC supplementary resources is counted to analyze their problem orientation and strategy adjustment ability.Natural language processing technology is applied to analyze the reflective text for sentiment analysis and cognitive hierarchy classification to assess the level of metacognitive development.

Digital Literacy and Ethical Awareness Assessment.The ethical dilemma scenario is embedded in the case generated by AIGC, and students are required to submit a solution and explain the ethical rationale.Through simulated cyberattack experiments, students' mastery of information security protection technology is assessed, and a “security literacy score” is generated.

Affective Attitude and Learning Motivation Monitoring.A blended assessment approach is used to construct a motivational strength model by combining the Learning Interest Scale, Growth Mindset Questionnaire, and behavioral data[11]. AIGC dynamically generates adaptive feedback, such as pushing motivational cases for motivationally attenuated students, and records subsequent changes in their engagement to form a closed loop of emotional support.

The above indicators are visualized in real time through the multi-dimensional dashboard in the blockchain resource sharing platform, which supports teachers to dynamically adjust their teaching strategies. In the final report, AIGC automatically generates a comprehensive evaluation matrix covering the dimensions of knowledge, skills and attitudes, realizing the upgrading of the assessment from “single result-oriented” to “whole-person development-oriented”.

5 Case Studies

Taking the “Smart Site Safety Early Warning System” project as an example, which requires student teams to develop a comprehensive system integrating IoT monitoring, data visualization and virtual reality display, AIGC technology has shown a significant empowering effect in the implementation of the project. In the content generation phase, AIGC pushed the integration case of BIM modeling and sensor deployment for the smart construction students, and generated Three. js visualization code templates for the digital media students. Students encountered difficulties in developing the data display interface, AIGC parsed their code and automatically generated an interactive chart improvement plan based on D3.js with dynamic evolution annotations to help them break through technical bottlenecks. The dynamic learning path design is reflected in the project progression regulation.The initial path sets uniform milestones for all teams, but AIGC continuously monitors the progress of each team, and when it finds that a team is lagging behind in the virtual reality module, it automatically pushes a streamlined version of the Unity engine tutorial for it and adjusts the weights of the subsequent tasks to ensure that the project advances as a whole. Interdisciplinary collaboration mechanism is seamlessly realized through AIGC. The monitoring program parameters designed by the smart construction students were converted by AIGC into visual mapping rules understandable by the digital media students; the warning animation prototypes produced by the digital media were parsed by AIGC to generate code interfaces that could be integrated by the smart construction students. A team used AIGC to convert safety warning data into heat maps to visualize the distribution of site risks. The innovation was evaluated by AIGC and incorporated into the case library for subsequent teaching.

Evaluation of the project results showed that teams supported by AIGC achieved a 32% improvement in functional completion and a 41% improvement in interdisciplinary knowledge integration. Student feedback shows that the personalized resources provided by AIGC effectively reduce the cognitive load of complex technology, dynamic path adjustment makes the learning pace more in line with individual needs, and the process of inter-disciplinary collaboration is smoother due to the “translation” function of AIGC. This case verifies the practical value of AIGC-enabled personalized teaching model in improving teaching quality and stimulating innovation potential.

6 Conclusion

In this study, through exploring the AIGC technology-enabled cross-professional group personalized teaching mode of information technology courses, we constructed a four-dimensional framework of “demand analysis-content generation-path design-collaboration mechanism”, which effectively solved the pain points of poor knowledge articulation and difficult to meet personalized needs in traditional teaching. Based on the theories of constructivism and mastery learning, combined with multi-source data-driven student profile analysis, AIGC technology realizes the dynamic generation and adaptation of precise teaching resources, and significantly improves students' interdisciplinary integration ability and project practice level through intelligent path recommendation and inter-professional collaboration mechanism. The case study shows that the model not only reduces the cognitive load of complex technology, but also stimulates students' innovative potential through dynamic adjustment of learning paths and integration of multidisciplinary resources, so that educational fairness and teaching efficiency are optimized. It provides an innovative path for the reform of information technology curriculum and contributes theoretical and practical references for the transformation and upgrading of education model in the era of artificial intelligence.

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