

Construction of a Digital Teaching Platform Based on AIGC and Its Practical Study in Marine Engineering Education

Genyuan Wang, Jiafa Liu

Hainan Vocational University of Science and Technology, Haikou, Hainan 571126

Abstract: Artificial intelligence-generated content (AIGC) technology is bringing profound changes to the field of education, showing significant potential particularly in ship engineering education. Traditional teaching methods face issues such as fragmented courses, weak practical training, and a disconnect between education and industry. AIGC can dynamically generate 3D ship models, virtual scenarios, and interactive tasks, addressing the shortage of teaching resources and enhancing learning efficiency through intelligent recommendations. Focusing on the innovative application of AIGC in ship engineering education, this research aims to build a digital teaching platform that integrates generative resources with intelligent service functions and conducts practical teaching validation. By collaboratively developing standardized course packages with enterprises and incorporating real-world cases into the teaching process, a closed loop of 'teaching-practical training-industry application' is formed, narrowing the gap between talent cultivation and industry needs. The research outcomes can provide replicable practice models for similar disciplines, promoting the intelligent transformation of ship engineering education and the development of digital capabilities.

Keywords: Generative Artificial Intelligence; Ship Engineering Education; Digital Teaching Platform

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1.The Theoretical Basis and Current Practice of AIGC Empowering Education

1.1 Technical Features of AIGC and Its Applications in Education

AIGC technology features massive data processing, content creativity, cross-modal integration, and cognitive interaction capabilities, bringing revolutionary changes to the education sector. Massive data processing supports the construction of extensive knowledge bases, while content creativity enables AI to dynamically generate personalized learning resources, such as text generation by ChatGPT and virtual simulation scenario creation. The adopted AIGC technology architecture consists of three layers: The data layer uses the BERT model to process text data and the Stable Diffusion model to generate image resources; the algorithm layer optimizes content generation strategies through reinforcement learning; the application layer realizes the integration of multimodal resources. Cross-modal integration technology combines text, images, audio, and other multidimensional information, enhancing the learning experience, while cognitive interaction is achieved through natural language processing to enable deep human-computer dialogue, providing students with instant feedback and guidance. These technologies not only address the limitations of traditional education resources being single and slow to update but also make it possible to implement comprehensive teaching in ship engineering.

1.2 Trends in Educational Reform: From Classroom Teaching to Human-Machine Collaboration

The traditional classroom teaching model is gradually being replaced by a human-AI collaborative approach, as standardized teaching struggles to meet individualized needs. AIGC uses intelligent analysis of student data to customize learning paths, such as generating 3D models of ship structures or cargo handling simulation tasks, addressing the shortcomings of personalized instruction in traditional classrooms. The role of teachers is also transforming, shifting from knowledge transmitters to guides who focus on cultivating values and stimulating creativity, while knowledge delivery is efficiently handled by AI. This transformation aligns with the concept of the 'super teacher,' where human teachers and AI complement each other to optimize the educational ecosystem.

1.3 Shortcomings of Existing Online Teaching Platforms and Directions for Improvement

Current online teaching platforms generally face issues such as uneven resource quality, weak interactivity, and a single evaluation system. For example, in ship engineering education, the lack of practical resources makes it difficult for students to understand abstract concepts. AIGC technology can enhance resource adaptability by dynamically generating high-fidelity experimental modules and intelligent question banks; its multimodal interaction features can increase learning immersion, while interest-graph-based intelligent recommendations can accurately match students' needs. These improvements provide a technical path for building a new generation of digital teaching platforms, promoting the transition of education from "standardized" to "personalized" and "intelligent".

2. Framework Design of a Digital Teaching Platform Based on AIGC

2.1 Platform Architecture and Core Modules

The AIGC-based digital teaching platform is structured around three core modules: 'User-Resource-Platform,' aiming to provide personalized, intelligent, and collaborative teaching services. The user module analyzes learning behavior data through interest graphs, dynamically generating personalized learning paths, and supports multiple evaluation mechanisms such as self-assessment, peer assessment, and real-time feedback generated by AI, accurately catering to the diverse needs of naval architecture students. The resource module integrates initial resources with resources dynamically generated by AIGC, using cross-modal fusion technology to intelligently reorganize and push multi-form resources such as text, images, and videos. The platform module, relying on an intelligent Q&A system, resource management system, and user data analysis system, builds a closed-loop service ecosystem. For example, the intelligent Q&A system uses natural language processing technology to interpret student questions and generate instant answers, the resource management system employs blockchain technology to ensure compliance and update efficiency of generated content, and the user data analysis system optimizes teaching strategies through machine learning.

2.2 AIGC Technology Integration Plan

In maritime engineering education, AIGC technology achieves deep application through three major scenarios: First, the generation of 3D ship structure models, where generative AI dynamically constructs interactive hull models, allowing students to observe structural changes in real-time by adjusting parameters, addressing the issues of static models and high update costs in traditional teaching; second, virtual simulation of cargo operations, following the 'contextual AI-driven' concept, developing multi-role task scripts, and using AR/VR technology for immersive training to enhance students' practical engineering skills; third, intelligent assessment and feedback, utilizing natural language processing technology to automatically grade open-ended assignments and generating personalized recommendations based on learning data, such as recommending targeted training resources for weak points in structural design, creating a 'learn-assess-improve' closed loop.

2.3 Design of Industry-Education Collaboration Mechanism

The platform bridges the gap between teaching and industry demands through a school-enterprise collaboration mechanism. On one hand, real shipping company cases are introduced as teaching materials, with company experts participating in case annotation and course design to ensure that teaching content accurately maps to job competencies. On the other hand, schools and enterprises jointly build 'virtual-on-site' experimental modules. For example, real-time shipping data provided by companies is embedded in the platform for students to simulate decision-making, while students also engage in ship inspections or cargo dispatch practices at enterprises, forming a dual-track teaching model of 'online simulation training – offline hands-on validation.' In addition, blockchain technology is used to record student training data and share it with partner companies, providing a basis for talent selection and course optimization, ultimately establishing an ecosystem that links teaching, industry, and employment.

3. Practical Cases in Naval Engineering Education

3.1 Course Development and Implementation

Using the course 'Ship Structure and Cargo Integration' as a platform, the project team has built a full-process teaching system covering ship design and cargo management based on AIGC technology. In the structural design module, interactive 3D hull models are dynamically created using generative AI, allowing students to adjust parameters in real time and observe changes in mechanical performance, addressing the issues of static models and high update costs in traditional teaching. The cargo simulation module, relying on virtual simulation technology, develops multi-role task scripts, enabling students to experience the entire cargo dispatch process immersively through AR/VR devices, thereby enhancing engineering practice skills. The course adopts a 'task-driven, AI-assisted' model, where AIGC automatically generates project task briefs. Students work in groups to complete design plans, perform simulation verification, and present reports, while teachers monitor progress in real time through an intelligent platform and provide personalized feedback, achieving a shift from knowledge transmission to capability development.

3.2 Analysis of Teaching Effectiveness

Feedback from students in the pilot classes indicated that dynamic resources generated by AIGC significantly enhanced learning interest. 85% of students believed that virtual simulation training was "intuitive and easy to understand," particularly in cargo handling process simulations, where task-based learning made abstract theories concrete. Teacher feedback showed that AI-assisted lesson preparation improved efficiency by about 40%, and the intelligent evaluation system could automatically grade open-ended assignments and generate learning analytics reports, helping teachers accurately identify students' weak points. Assessment reports from partner companies pointed out that graduates who participated in the project had a 25% higher pass rate in job skills tests, especially performing well in tasks such as "hull structure troubleshooting" and "multi-condition cargo transportation decisions," confirming the alignment of course content with industry needs.

3.3 Challenges and Optimization

The current practice faces two core challenges: first, the latency issue in multimodal data fusion, which requires optimization of algorithms to improve interactive response speed; second, the reliability risk of AIGC-generated content, such as potential deviations from physical laws in virtual simulations, necessitating the introduction of enterprise expert review mechanisms. In the future, it is planned to balance technological innovation and teaching rigor by jointly training specialized models through school-enterprise collaboration and establishing content verification rules, while also exploring blockchain technology to achieve resource traceability, ensuring the safety and compliance of AIGC in educational applications.

4. Conclusion

Building a digital teaching platform based on AIGC has effectively addressed the challenges of resource shortages and weak practical components in ship engineering education. By leveraging generative AI technology to dynamically create three-dimensional ship models, virtual cargo transport scenarios, and other teaching resources, it has significantly enhanced students' cognitive efficiency and engineering practice capabilities. Through a human-computer collaborative teaching model, it not only enables personalized adaptation of learning paths but also strengthens industry alignment through a university-enterprise collaboration mechanism, validating the innovative value of AIGC in engineering education. Future research will further improve the platform's interaction efficiency and content security by optimizing algorithms, introducing expert review mechanisms, and exploring blockchain technology. This study provides a replicable practical paradigm for the intelligent transformation of ship engineering education and offers an important reference for educational reform in other engineering disciplines. The deep application of AIGC technology not only drives innovation in educational resources but also reshapes the

"human-computer collaborative" educational ecosystem, laying a solid foundation for cultivating engineering talents suited to the digital era.

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