

Research on the Reconstruction of Teaching Content in Programming Courses Based on Design Thinking Empowered by Intelligent Technology

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Abstract: This study focuses on the perspective of deep integration of intelligent technology and design thinking, and explores the path of curriculum reconstruction in traditional programming courses, addressing pain points such as fragmented content, emphasis on theory over practice, and rigid teaching modes. By sorting out the core mechanism of intelligent technology empowering education and the innovative methodology of design thinking, clarify the feasibility and value of coupling the two in curriculum reconstruction; Analyze the existing problems of traditional courses, establish reconstruction principles such as user centeredness, technological empowerment, and iterative optimization; Furthermore, a teaching content reconstruction framework of "requirement analysis scheme design prototype iteration multiple evaluation" will be constructed, and the effectiveness of the scheme will be verified through practical cases. The research aims to provide theoretical references and practical paradigms for cultivating programming talents with innovative thinking and practical abilities, and promote the intelligent and humanized transformation of programming course teaching.

Keywords: Intelligent Technology; Design Thinking; Programming Courses; Reconstruction of Teaching Content

1. Introduction

In the context of digital transformation, the demand for innovative programming talents in various industries has surged, but the problem of traditional programming courses' emphasis on syntax over application and emphasis on indoctrination over innovation is prominent. The teaching content is detached from practical scenarios, making it difficult for students to transform theory into practical abilities; The

solidification of teaching mode limits students' innovative thinking and makes it difficult to adapt to the development needs of the industry. In this context, the personalized empowerment of intelligent technology combined with the innovative orientation of design thinking has become the key to solving the pain points of the curriculum. This study not only enriches the educational theoretical system of integrating technology and thinking, but also provides an operational path for curriculum reform in universities, with both theoretical and practical value.

Research at home and abroad has made progress in innovative teaching methods, application of intelligent educational tools, and integration of design thinking into engineering. However, existing research has shortcomings such as insufficient integration of technology and curriculum content, and lack of specific paths for the application of design thinking. This study adopts the methods of literature research, case analysis, and action research, following the logic of "theoretical basis problem analysis principle establishment path construction practical outlook", to construct a complete research system.

2. Theoretical Coupling Analysis of Intelligent Technology Empowerment and Design Thinking

The core of empowering education with intelligent technology is to rely on technologies such as artificial intelligence, big data, and virtual simulation to achieve precise teaching, personalized resources, and diversified evaluation. Its application forms focus on intelligent learning situation analysis (accurately depicting students' learning profiles), virtual programming laboratories (immersive practice environments), and intelligent evaluation systems (multi-dimensional dynamic evaluation), breaking the standardization limitations of traditional education.

Design thinking takes "people-oriented, problem oriented, iterative innovation" as its core, and guides learners to solve complex problems from the perspective of user needs through the process of "requirement insight solution conception prototype production testing iteration". In the field of education, its value lies in stimulating innovative consciousness, cultivating problem-solving abilities, and highly adapting to the practical attributes of programming courses. There is a natural coupling between the two: intelligent technology provides tool support for design thinking, such as big data to assist in demand insight and virtual simulation to accelerate prototype iteration; Design thinking provides direction for the application of intelligent technology, avoids technological accumulation, and focuses on cultivating students' abilities. The dual empowerment of "technological tools+innovative thinking" forms the theoretical basis for curriculum content reconstruction.

3. Examination of Pain Points and Establishment of Refactoring Principles in Traditional Programming Courses

There are three core problems with traditional programming courses: in terms of content organization, knowledge points are fragmented and disconnected from practical applications, making it difficult for students to construct a systematic knowledge system; In terms of teaching mode, teacher lectures are the main focus, while students learn passively, lacking space for exploration and innovation; In terms of evaluation system, emphasis is placed on written test scores, neglecting practical ability and innovative thinking assessment, resulting in one-sided evaluation results.

Based on intelligent technology and design thinking, four reconstruction principles are established: firstly, the user centered principle, designing content guided by students' learning needs and career development; The second is the principle of technological empowerment, integrating intelligent tools into the entire teaching process to achieve personalized support; The third is the principle of iterative optimization, which dynamically adjusts teaching content by drawing on design thinking logic; The fourth principle is the integration of knowledge and action, using projects as a carrier to strengthen the integration of theory and practice, and enhance application capabilities.

4. The Path of Reconstructing the Teaching Content of Programming Courses Based on Design Thinking

4.1 Requirement Insight: Content Module Planning Based on Intelligent Learning Analysis

Using learning management systems, online programming platforms, and other tools, collect multi-source data on students' knowledge base, learning preferences, and skill gaps, and construct learning profiles. Based on the industry job requirements, the course content is divided into four modules: "Basic Grammar - Algorithm Design - Project Practice - Innovation and Expansion", achieving hierarchical and precise design to meet the needs of students at different levels. The basic module consolidates the grammar foundation, the algorithm module cultivates logical thinking, the project module strengthens practical application, and the innovation module explores cutting-edge fields.

4.2 Scheme Concept: Project based Content Organization Incorporating Design Thinking

Breaking the chapter based arrangement, integrating knowledge points with real projects as carriers, and constructing a progressive system of "small verification projects - medium comprehensive projects - large innovation projects". Small projects consolidate the foundation, medium-sized projects comprehensively apply multiple knowledge points, and large-scale projects encourage independent innovation. Each project follows the design thinking process: requirement analysis to identify user pain points, proposal of diverse ideas, code implementation to transform creativity, testing iteration optimization effects, allowing students to actively construct knowledge in solving practical problems.

4.3 Prototype Iteration: Dynamic Optimization of Content based on Intelligent Tools

Utilize tools such as virtual programming laboratories and code intelligent evaluation systems to support students in quickly building prototypes and testing. Based on platform feedback on project completion status, code quality, and other data, dynamically adjust teaching difficulty and progress; Based on student feedback, optimize project cases and

knowledge coverage to form a virtuous cycle of "teaching feedback optimization", ensuring that teaching content continues to adapt to student needs.

4.4 Multivariate Evaluation: Content Effectiveness Evaluation based on Process Data

Building a "smart evaluation+teacher evaluation+student peer evaluation" system: smart evaluation automatically detects the correctness and standardization of code; Teacher evaluation focuses on the professionalism and innovation of project proposals; Student peer evaluation focuses on team collaboration performance. The comprehensive multidimensional evaluation results comprehensively reflect students' knowledge mastery, practical ability, and innovative thinking, providing scientific basis for optimizing teaching content.

5. Practical Application and Development Prospects of Refactoring Solutions

Taking the "Python Programming" course at a certain university as a practical case, students are divided into three levels: basic, advanced, and expanded through intelligent learning analysis before class, and personalized preview materials are pushed; During class, project-based teaching is carried out around the "Campus Intelligent Management System" project, following the design thinking process, integrating multiple knowledge points to achieve comprehensive application; Collect data and evaluate it through an intelligent platform after class, and optimize teaching based on student reflection. Practice has verified the operability and effectiveness of the plan.

At the level of expected results, the student dimension will enhance their programming practical ability and innovative thinking, the teacher dimension will achieve precise teaching and reduce workload and increase efficiency, and the curriculum dimension will complete the transformation from "knowledge imparting" to "ability cultivation". This plan provides reference for similar curriculum reforms and

promotes the intelligent and innovative development of education and teaching.

This study has limitations such as a small sample size and a short practical period. In the future, the sample coverage can be expanded and the tracking research period can be extended. Looking ahead to the future, it is necessary to further deepen the integration of intelligent technology and design thinking, build an interdisciplinary programming project system, improve the intelligent evaluation mechanism, continuously optimize the reconstruction plan, and cultivate more innovative programming talents that meet the needs of the times.

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References

- [1] Mou Luntian Exploration of Computer Programming Teaching in the Era of Artificial Intelligence [J]. Science and Education Guide, 2018 (3): 3. DOI: CNKI: SUN: KJDX. 0.2018-01-049
- [2] Wang Lei, Ling Qiang, Shengjie Exploration of Computer Programming Course Teaching for the Intelligent Era [J]. Computer Education, 2024 (6): 146-150
- [3] Jia Xinyu, Zhu Xiaomi, Zhou Bing Exploration of Teaching Reform in C Language Programming Course in the Era of Artificial Intelligence [J]. Information and Computer, 2025, 37 (24): 229-232
- [4] Li Chuanzhen Exploration and Practice of Teaching Reform in Programming Courses in the Era of Artificial Intelligence [J]. Technology and Innovation, 2021. DOI: 10.15913/j.cnki.kjycx.2021.01.036
- [5] Xu Qin, Qiao Yulong, Wu Zixing, etc Innovation of Teaching Mode for Programming Courses Empowered by Artificial Intelligence [J]. Chinese Journal of Science and Technology, 2025 (1): 233-239.