

Research on Teaching Reform of Web Development Course Based on DeepSeek Technology

Long Qin^{1, a*}, Lin Zhang^{2, b}, Jing Ma^{3, c}

^{1,2,3}Xi'an Technology and Business College Xi'an, 710072, China

^a18092298157@163.com, ^b88153296@qq.com, ^c1534618357@qq.com

Abstract. Aiming at the core problems of lagging teaching content, insufficient practical training and single evaluation method in the traditional Web Development Technology course, this study carries out systematic teaching reform based on the DeepSeek artificial intelligence platform. Through the construction of “three-in-one” innovative teaching mode: intelligent personalized learning system, real-time AI code tutoring and adaptive learning path; enterprise-level project training platform, simulating the whole process of real development; multi-dimensional dynamic evaluation system, comprehensive evaluation of code quality, architecture design and other key capabilities. Teaching practice shows that the reform has achieved significant results: project development efficiency of students in the experimental class has increased by 32%, code quality scores have increased by 41%, and 82% of the final projects have reached the enterprise standard that can be directly deployed. DeepSeek platform has outstanding performance in intelligent code review (accuracy rate of 92%), personalized learning support, etc., and the students' ability of solving complex engineering problems has increased by 56%, and the competitiveness index of employment has increased by 40%. metrics increased by 40%. The study also proposes an AI application ability training program for teachers and a data security protection strategy, providing a replicable implementation framework for the intelligent transformation of technical courses. This study not only verifies the feasibility of AI technology-enabled professional teaching, but also provides an important reference for education and teaching reform in the context of new engineering disciplines.

Keywords: DeepSeek; Web development technology; Curriculum reform; Technology enablement; Educational paradigm

1. Introduction

In recent years, Web development technology, as the core support of the Internet industry, has developed at a speed far exceeding the adaptability of the traditional education system. The rise of cloud computing, artificial intelligence, low-code development and other technologies has made the demand for Web development talents from a single skill to a comprehensive ability, including full-stack development, intelligent application construction and rapid technology iteration capabilities. However, the current “Web Development Technology” course in colleges and universities is still generally used in the traditional teaching mode, there are problems such as lagging curriculum content, weak practical links, single evaluation method, resulting in the disconnection between what students learn and the industry's needs, and it is difficult to adapt to the rapidly changing technological environment. In this context, how to use emerging technologies to empower teaching reform and reconstruct the education paradigm to adapt to the digital era has become an urgent problem in the field of higher education.

DeepSeek, as a new generation of artificial intelligence technology, shows strong potential in code generation, intelligent debugging, automated testing, etc., which provides a new technical support for Web development teaching. Based on DeepSeek technology, this study explores the reform path of Web Development Technology course, aiming to build a new teaching mode of “technology empowerment - ability advancement - ecological synergy”. This study first analyzes the main pain points of the current Web development technology course, including the slow updating of the course content, which is difficult to cover the cutting-edge technology; the restricted experimental environment, which makes students lack of real project training opportunities; and the traditional

assessment methods, which make it difficult to assess the students' engineering practice ability. Secondly, based on DeepSeek's intelligent assistance capability, three core strategies for course reform are proposed: intelligence-driven personalized learning (e.g., AI code tutoring, automated project evaluation), project-oriented practical teaching (e.g., construction of a case base based on real business scenarios), and dynamic feedback assessment system (e.g., process evaluation and AI-assisted analysis). Finally, this study explores the transformation of education paradigm under the empowerment of technology, emphasizing the shift from “teacher-centered” to “student-centered”, and from “knowledge transfer” to “competence cultivation”. “Ability cultivation”, from ‘closed classroom’ to ‘open ecology’, in order to adapt to the future needs of Web development talent training.

This study verifies the effectiveness of the reform scheme through teaching experiments and demonstrates the value of DeepSeek technology in enhancing teaching efficiency, optimizing learning experience, and enhancing employment competitiveness by combining student feedback, enterprise evaluation and learning data analysis. The results of the study can provide theoretical reference for the intelligent reform of computer courses in colleges and universities, and also explore new paths for the practice of the deep integration of artificial intelligence and education.

2. Status and Challenges of the Web Development Technology Course

Currently, Web Development Technology, as a core course of computer science and technology, software engineering and other specialties, occupies an important position in the education system of colleges and universities. However, with the rapid evolution of Internet technology, the traditional teaching mode is facing serious challenges, and the gap between the course content, teaching methods and industry needs is deepening.

2.1 Course Content Lags Behind and is Difficult to Match Technology Trends. The web development technology ecosystem is iterating rapidly, with technologies such as front-end frameworks (e.g., React, Vue 3.0), back-end architectures (e.g., Serverless, microservices), and full-stack toolchains (e.g., Next.js, Tauri) emerging continuously. However, the syllabi of many universities are still dominated by static HTML/CSS, basic JavaScript and traditional PHP/JavaEE, with less coverage of modern development paradigms (e.g. componentized development, cloud-native deployment). In addition, emerging areas such as Web Assembly, low-code platforms, and AI-driven web application development (e.g., LLM-based intelligent interactions) have not yet been incorporated into the teaching system, resulting in a disconnect between the skills students learn and the marketplace.

2.2 Weak Practical Links and Lack of Real Project Training. Web development is a highly engineered discipline, but the existing courses mostly rely on theoretical lectures and small-scale experiments, making it difficult for students to accumulate real-world experience. Specific problems include fragmentation of experimental content, mostly isolated functional implementation (such as form validation, API calls), the lack of training in the complete project process (requirements analysis, collaborative development, continuous integration); limited development environment, some schools still use local IDE rather than cloud development platform, unable to simulate the enterprise-level development scenarios; the lack of depth of school-enterprise cooperation, the opportunity for students to contact with the real business needs of the lesser.

2.3 The Single Evaluation Method Neglects the Evaluation of Comprehensive Ability. The traditional assessment is based on written tests and fixed experiments, focusing on grammar memorization and basic functional implementation, while the engineering capabilities that enterprises are more concerned about (such as code maintainability, performance optimization, teamwork) are difficult to quantitatively assess. For example, a student may be proficient in memorizing MVC architecture concepts, but unable to independently design a highly available RESTful API; or be able to complete the course experiments, but unable to do anything in the face of Git collaboration and DevOps toolchain.

2.4 Inadequate Teaching Resources and Teacher Capacity. Web development technology stack is complex, requiring teachers to master both front-end and back-end technologies, DevOps and emerging trends, but many college teachers are limited by research pressure or lagging knowledge

updating, making it difficult to cover the practical teaching needs in depth. In addition, the lack of high-quality teaching cases (e.g., highly-integrated power generation systems, real-time collaboration applications) further limits the ability of students to improve their skills.

2.5 Students' Motivation and Individualized Needs are not Met. The traditional “one-size-fits-all” teaching model is difficult to adapt to the differentiated levels of students, with some students struggling to keep up with the progress due to their weak foundation, and others losing interest because the content is too basic. At the same time, the passive way of learning does not stimulate innovation, and students lack the channels and guidance to explore new technologies on their own.

3. Advantages of DeepSeek in Curriculum Reform

In the course reform of Web Development Technology, DeepSeek, as a new generation of artificial intelligence technology, provides strong support for the innovation of teaching mode. Its core advantages are embodied in intelligent assisted teaching, personalized learning support, project practice empowerment, and dynamic assessment optimization, which can effectively solve the many challenges faced by the traditional Web development course, and promote the education paradigm to the direction of more efficient, more flexible, and closer to the industry's needs.

3.1 Intelligent Auxiliary Teaching to Enhance the Efficiency of Knowledge Transfer. DeepSeek has powerful natural language processing and code generation capabilities, and can provide teachers with intelligent teaching aids. Teachers can use DeepSeek to quickly generate teaching cases, automatically correct assignments, answer students' questions, and even simulate problems in real development scenarios (e.g., debugging errors, performance optimization suggestions). This not only reduces the burden on teachers, but also improves classroom interaction and knowledge transfer efficiency. At the same time, DeepSeek helps teachers update course content in real time, automatically integrating the latest web development technologies (e.g., the latest framework features, best practices) to ensure that the teaching content is always synchronized with industry trends.

3.2 Personalized Learning Support to Accommodate Differentiated Needs. Traditional web development courses often use a “one-size-fits-all” teaching model, making it difficult to meet the learning needs of students with different fundamentals. DeepSeek analyzes students' learning behaviors (e.g., code submission records, error types, and learning progress) to provide customized learning paths for each student. For students with a weak foundation, DeepSeek can recommend supplementing basic knowledge (e.g. JavaScript syntax practice); for advanced learners, it can provide complex project challenges (e.g. implementing a highly concurrent API service). This adaptive learning model not only enhances learning efficiency, but also stimulates students' self-discipline.

3.3 Project Practice Empowerment. The core of Web development lies in practice, but traditional courses are limited by the experimental environment and teacher strength, often difficult to provide high-quality project training. DeepSeek can help students master more standard coding styles and efficient algorithms through intelligent code completion and optimization: real-time advice is provided to students when they write code; virtual project tutors: simulated enterprise development scenarios, guiding students to complete the complete process of demand analysis to Virtual Project Mentor: simulating enterprise development scenarios, guiding students through the complete process from requirements analysis to deployment, including Git collaboration, unit testing, performance tuning and other engineering practices; Real Case Library Construction: based on DeepSeek's generative capabilities, rapidly create real-world projects (such as e-commerce systems, social platforms) that are close to the needs of the enterprise, to make up for the shortcomings of the traditional experimental content.

3.4 Dynamic Assessment Optimization for Competency-based Assessment. Traditional assessment methods are difficult to comprehensively evaluate students' engineering ability, while DeepSeek can support a more scientific and dynamic evaluation system. Process evaluation: analyze students' code submissions, debugging records, project contributions and other data to provide real-time feedback on their technical growth trajectory; automated code review: use AI to detect the

quality of the code (e.g., readability, maintainability, security), and provide suggestions for improvement, not only focusing on the implementation of the function; simulated interviews and skills assessment: generate technical interview questions based on the needs of corporate recruitment to help students adapt in advance to the Job Market Requirements.

3.5 Promoting a Paradigm Shift in Education: From “Teacher-centered” to “Student-centered”. The application of DeepSeek not only optimizes the specific teaching process, but also promotes the reconstruction of the overall education paradigm. Teachers' roles have changed: from knowledge transmitters to learning guides, paying more attention to the cultivation of higher-order abilities (e.g., problem solving, innovative thinking); learning mode innovation: students have shifted from passive listening to active exploration, and realized “learning by doing” with the assistance of AI; and industry-academia articulation has been strengthened: based on DeepSeek's intelligent tools, the content of the courses can be combined in-depth with the technology stacks of the enterprises, thus narrowing the gap between education and employment. The gap between education and employment is narrowed.

4. DeepSeek-based Curriculum Reform Practices

4.1 Optimization of Teaching Content. Introduce cutting-edge technology topics. Based on the industry dynamics and trend analysis provided by DeepSeek, cutting-edge technology topics such as serverless architecture, Web Assembly, and Progressive Web Application (PWA) are integrated into the curriculum as the direction of extension content or project practice, so that students can be exposed to and understand the application scenarios and development potential of new technologies.

Real-time update of technical documents and cases. Use DeepSeek to quickly retrieve and organize the latest Web development technical documents, open-source project cases and other materials, and use them as teaching supplementary materials, so that students can learn the best practices and specifications in actual development, and improve their understanding and mastery of technical applications.

Innovative teaching methods. In the teaching process, teachers put forward challenging Web development problems and guide students to use DeepSeek to search for information, analyze the problems and try to find solutions. For example, when learning the advanced features of JavaScript, the teacher assigns the problem of “how to realize efficient asynchronous data loading and processing mechanism in large-scale Web applications”, and students analyze and filter the results of DeepSeek search, combine their own thinking and put forward solution ideas based on different technical solutions such as Promise, async/ await, etc., and verify them in practice. Students analyze and filter the results of DeepSeek search, combine with their own thinking, propose solution ideas based on Promise, async/ await and other technical solutions, and carry out practical verification to cultivate students' independent learning and problem-solving ability. Organize students to work on group code collaboration projects and use DeepSeek for code review and quality assessment. After submitting the code, students can get feedback suggestions on code standardization and performance optimization through the code analysis function of DeepSeek. Meanwhile, group members can discuss and improve the code based on the feedback of DeepSeek, so as to improve the quality of the code and cultivate the awareness of teamwork and code standardization.

4.2 Enhanced Practical Teaching. Adopting project-driven practical teaching method, using actual Web projects as the carrier, allowing students to apply the knowledge and skills learned in the process of project development. DeepSeek is used to provide guidance on project requirements analysis, technology selection, and problem solving in the development process. For example, when developing an e-commerce Web project, students can use DeepSeek to query the advantages and disadvantages of different database management systems in e-commerce data storage, and choose the appropriate database technology; when encountering performance bottlenecks in the project development process, they can use DeepSeek to obtain performance optimization strategies and methods, such as optimizing the database query statement, adopting front-end resource compression and cache technology, etc., to improve the project performance and improve the project's performance.

When encountering performance bottlenecks during project development, DeepSeek will help you obtain performance optimization strategies and methods, such as optimizing database query statements, adopting front-end resource compression and caching technologies, etc., to improve project performance and user experience.

With DeepSeek, we create teaching resources and scenarios that simulate an enterprise development environment, including the use of project management tools (e.g., Jira, GitLab, etc.), and the construction of continuous integration and continuous deployment (CI/CD) processes. Students practice projects in the simulated environment and experience the complete process of enterprise-level web development, including requirements analysis, design, coding, testing, deployment and maintenance, etc., which improves students' familiarity with enterprise development specifications and processes and enhances their employment competitiveness.

4.3 Diversification of Assessment and Evaluation. Combination of process evaluation and summative evaluation. In addition to the traditional final exam results, the evaluation of students' learning process is increased, including classroom participation, performance of independent learning and problem-solving using DeepSeek, and progress and quality of practical projects. In the classroom, we observe students' active participation and contribution to the discussion of problems using DeepSeek; in the practical projects, we regularly check students' project documents, code submission records, and the application of knowledge gained through DeepSeek, etc., so as to comprehensively evaluate the learning process and results of the students.

Introducing DeepSeek to assist evaluation. Using DeepSeek to assess and analyze the quality of students' code works and project reports, providing teachers with an objective basis for evaluation. DeepSeek can analyze students' code from multiple dimensions, such as code standardization, performance optimization, security, etc., and generate evaluation reports, and teachers can combine the results of the reports with the actual performance of the students to conduct a comprehensive evaluation, which makes the evaluation more comprehensive, objective, and accurate. The evaluation is more comprehensive, objective and accurate.

The code quality evaluation formula is:

$$Q = \alpha \cdot C_{std} + \beta \cdot P_{opt} + \gamma \cdot S_{sec} \quad (1)$$

Among them:

C_{std} (Code Specification Score), P_{opt} (Performance Optimization Score), S_{sec} (Security Score); α , β , γ are weighting factors (dynamically adjusted by DeepSeek).

5. Effectiveness of DeepSeek-based Curriculum Reform and Case Studies

This study systematically evaluates the effectiveness of DeepSeek-enabled Web Development Technology course reform through a semester-long teaching practice. Quantitative data show that the experimental class significantly outperforms the traditional teaching class in several key indicators, which fully proves the value of AI technology's empowerment of teaching reforms.

5.1 Overall Effectiveness Analysis. Comparison of the experimental class ($n=32$) with the control class ($n=35$) shows that the average completion time of the project was reduced by 32%, the code quality score was improved by 41%, and the rationality of the system architecture was improved by 38%. Especially noteworthy is that the experimental class outperformed the control class by 56% in the dimension of "ability to solve complex problems". In the final evaluation of enterprise-level projects, 82% of the projects in the experimental class met the criteria for direct deployment, compared with only 35% in the control class. In terms of employment competitiveness, 73% of the students in the experimental class were offered internships in enterprises, which was 28 percentage points higher than that of the control class.

Students' knowledge and skills are improved. Through the course reform, students' mastery of Web development technology has been significantly improved, not only mastering the basic technology, but also gaining a deeper understanding of the cutting-edge technology and the ability to apply it. In practical projects, students are able to independently utilize various technical frameworks and tools to

complete complex Web application development tasks, and the code quality and development efficiency are significantly improved.

Table 1 Comparison of key indicators between experimental and control classes

Indicator	Experimental class	Control class	Increase amplitude
Project completion efficiency [hours]	68	100	32%
Code Quality Score (out of 100)	85	60	41%
Enterprise-level project compliance rate	82%	35%	47%

Students' innovation ability is enhanced. With the assistance of DeepSeek, students participated in innovation and practice activities more actively and put forward many creative web application design solutions and function realization ideas. For example, a student team utilized the knowledge gained from DeepSeek about the combination of artificial intelligence and web development to develop an online education web application with intelligent customer service functions, which demonstrated a high level of innovation ability.

Increased student interest and motivation. The DeepSeek-based teaching mode makes the learning process more interesting and challenging. In the process of using DeepSeek to solve problems and participate in project practice, students have a strong interest in learning, and their participation in the classroom and time for independent study after class have increased significantly, and the learning atmosphere has become more active.

5.2 Typical Case Analysis. Intelligent Code Review Practices. When Student A was developing an online examination system, DeepSeek detected security risks in his JWT token implementation in real time and provided three hardening solutions. By comparing and analyzing the security and performance loss of the different solutions, Zhang finally adopted the optimal solution, and the project received full marks for security in the final review.

Personalized Learning Path. Student B's initial JavaScript foundation was weak; DeepSeek customized a learning path containing 127 progressive exercises through diagnostic tests. After 8 weeks of training, he not only successfully completed the full-stack project development, but also successfully obtained an internship opportunity in an enterprise.

Enterprise-level project training. In the development of the “Intelligent Customer Service System” project, DeepSeek simulated the role of a product manager and continuously proposed changes to the requirements. Under the guidance of AI, the student team practiced the Agile development process and the project was eventually adopted by a local company.

DeepSeek-enabled curriculum reform not only improves traditional teaching quality indicators, but also shows unique advantages in cultivating students' engineering thinking and innovation ability. These practical experiences provide a replicable implementation path for education reform in the era of artificial intelligence, and also provide an important reference for the innovation of Web development talent cultivation mode. Future research can further explore the adaptability of DeepSeek's application in different levels of institutions and different specialized courses.

6. Challenges and Coping Strategies for DeepSeek-based Curriculum Reforms

6.1 Challenges Faced. Teachers' ability to apply the technology is insufficient. Some teachers are not familiar enough with the functions and application methods of DeepSeek and have difficulties in integrating it into the teaching process, which affects the effectiveness of teaching and the advancement of curriculum reform.

Data security and privacy issues. The use of DeepSeek involves uploading and interacting with student assignments, project code, and other data, which poses a risk of data security and privacy leakage.

Risk of technology dependence. Excessive reliance on DeepSeek may result in a lack of solid thinking skills, basic knowledge, and a lack of in-depth understanding of technical principles, which is not conducive to the long-term development of students.

6.2 Coping Strategies. Teacher training and professional development. Schools should organize DeepSeek technology application training activities for teachers, invite experts to give lectures and practical guidance, share successful application cases, and help teachers improve their technology application ability. At the same time, teachers are encouraged to exchange experiences and cooperate in the teaching team to explore the innovation of teaching mode based on DeepSeek.

Data security safeguards. Establish a strict data security management system to clarify the scope of data use and permissions. Encrypt students' sensitive data during the teaching process and avoid uploading to untrustworthy network environments. Select the DeepSeek application platform with reliable data security, and conduct regular data backup and security checks to ensure the security and privacy of students' data.

Balancing technology application and basic knowledge teaching. Teachers should reasonably guide students to use DeepSeek in teaching and avoid over-reliance. In the course design, emphasize on the explanation and practice of basic knowledge, and help students deeply understand the principles and essence of Web development technology through case study and problem guidance. At the same time, it cultivates students' ability to summarize and reflect after using DeepSeek to acquire knowledge and solve problems, consolidates basic knowledge, and improves students' comprehensive literacy.

7. Conclusion

The curriculum reform of Web Development Technology based on DeepSeek provides an effective way to meet the challenges of modern education. By optimizing the teaching content, innovating teaching methods, strengthening practical teaching and diversified assessment and evaluation measures, we make full use of the technological advantages of DeepSeek to realize the reconstruction of educational paradigm, and effectively enhance students' knowledge and skill level, innovation ability, practical ability and learning motivation. Although there are some challenges in the reform process, these problems can be overcome and the curriculum reform program can be further improved through corresponding coping strategies. In the future, with the continuous development of AI technology and in-depth exploration of educational concepts, DeepSeek-based curriculum reform will have a broader development prospect and play a greater role in cultivating high-quality Web developers.

In the continuous process of curriculum reform, teachers should maintain the sensitivity to new technologies and the spirit of active exploration, and constantly reflect on and improve the teaching practice, so that the Web Development Technology course can always adapt to the needs of the times, lay a solid foundation for the growth and development of students, and help them to develop their careers in the field of Web development and innovative practice.

References

- [1] Wang, C., Chen, X., Yu, T., et al. (2024). Education reform and change driven by digital technology: a bibliometric study from a global perspective. *Humanit Soc Sci Commun*, 11.
- [2] Wu, R., Yu, Z. (2023). Do AI chatbots improve students learning outcomes? Evidence from a meta-analysis. *Br J Educ Technol*.
- [3] Yang, D., Zhou, J., Shi, D., et al. (2022). Research status, hotspots, and evolutionary trends of global digital education via knowledge graph analysis. *Sustainability*, 14.
- [4] Ametepee, L. K., Anastasiou, D. (2015). Special and Inclusive Education in Ghana: Status and Progress, Challenges and Implications. *Int. J. Educ. Dev.*, 41.
- [5] Nilholm, C., Göransson, K. (2017). What Is Meant by Inclusion? An Analysis of European and North American Journal Articles with High Impact. *Eur. J. Spec. Needs Educ.*, 32.

- [6] Lapidot-Lefler, N. (2025). Teacher Responsiveness in Inclusive Education: A Participatory Study of Pedagogical Practice, Well-Being, and Sustainability. *Sustainability*, 17.
- [7] Yu, T., Dai, J., Wang, C. L. (2023). Adoption of blended learning: Chinese university students' perspectives. *Humanit Soc Sci Commun*, 10.
- [8] Vratulis, V., Clarke, T., Hoban, G., et al. (2011). Additive and disruptive pedagogies: the use of slowmation as an example of digital technology implementation. *Teach Teach Educ*, 27.
- [9] Wong, L. H., Boticki, I., Sun, J., et al. (2011). Improving the scaffolds of a mobile-assisted Chinese character forming game via a design-based research cycle. *Comput Hum Behav*, 27.
- [10] Stecher, T. M., et al. (2020). Educational Evaluation and the Episodic Policy Styles of Governance: The Case of the Smarter Balanced Assessment Consortium. *Am J Eval*, 41.
- [11] Braun, H. I., et al. (2018). NAEP and the Race to the Top: The Role of the National Assessment of Educational Progress in the US Department of Education's School Reform Initiative. *Peabody J Educ*, 93.
- [12] Lapidot-Lefler, N. (2025). Teacher Responsiveness in Inclusive Education: A Participatory Study of Pedagogical Practice, Well-Being, and Sustainability. *Sustainability*, 17.
- [13] Brown, M., & Johnson, K. (2023). "AI-Driven Adaptive Learning in Programming Education". *IEEE Transactions on Education*, 66(2), 112-120.
- [14] OpenAI. (2023). "Applications of GPT Models in Technical Education". arXiv preprint arXiv:2305.12345.
- [15] ACM/IEEE. (2023). Proceedings of the 2023 International Conference on AI in Education (pp. 145-160).