Research on Innovative Reform of Teaching and Learning Paradigm in the Context of Digital Education

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Abstract. In the context of digital education, innovative reforms in teaching and learning paradigms have become the key to promoting modernization of education. This reform aims to break traditional teaching and learning models, fully utilize digital technology and resources, and achieve personalized, interactive, and efficient teaching processes. Innovation and reform emphasize the subjectivity and participation of students, encourage them to actively participate, explore and cooperate, and cultivate their self-learning ability and innovative spirit. At the same time, the reform also focuses on the scientific and systematic nature of the teaching process, and emphasizes the feedback and regulatory role of teaching evaluation. Through innovative reforms, we can better adapt to the educational needs of the digital age, improve educational quality, promote educational equity, promote changes in educational models, and inject new impetus into future educational development.

Keywords: Digitalization of education; Teaching paradigm; Learning paradigm; Teaching reform.

1   Introduction

The teaching and learning paradigm refers to the general term for the basic views, concepts, methods, and approaches to teaching and learning activities in the education and teaching process. It can be seen as a framework or pattern that defines the basic concepts, principles, and methods of how teachers teach and students learn during the teaching process. This paradigm not only reflects the teaching philosophy of teachers, but also reflects their understanding of the learning process of students. This article aims to explore new learning paradigms and effectiveness evaluation methods around digital teaching models, personalized learning, and collaborative learning in the context of educational digitization.

The first one is the digital teaching mode. Traditional face-to-face teaching has been supplemented or replaced by online courses, virtual classrooms, and blended learning models. The second is personalized learning. By analyzing student learning data, teachers can understand the learning characteristics and needs of each student, and tailor personalized learning plans for them, achieving true personalized teaching. The third is cooperative learning. Through online collaboration tools and platforms, students can

cross geographical boundaries and learn and communicate with people from different backgrounds and cultures. The fourth is the effectiveness evaluation method. Compared with traditional teaching evaluation methods, effectiveness evaluation in the digital context places more emphasis on process evaluation and diversified evaluation[1-4].

2   Construction Path

2.1   Design Innovative Teaching Models that Adapt to the Digital Age

Digital technology has brought revolutionary changes to teaching modes. Traditional face-to-face teaching has been supplemented or replaced by online courses, virtual classrooms, and blended learning models. Explore the application of new technologies such as virtual reality and artificial intelligence in teaching, build a diversified teaching environment that integrates digital technology, create a new digital teaching model that is interconnected, open, agile, and personalized, and provide intellectual support and motivation for the educational practice of digital transformation in education[5-6].

Taking civil engineering as an example, the new teaching model aims to explore innovative teaching models suitable for civil engineering from both theoretical and practical levels, in order to improve the quality of education and the comprehensive quality of students.

Firstly, based on the characteristics of civil engineering, innovative teaching objectives and design are carried out based on educational technology, involving the structure of the course content, design of learning paths, and selection of teaching resources in the Introduction to Civil Engineering, highlighting the application of digitization in teaching.

Secondly, in the context of digitalization in education, case teaching and project-based learning are conducted in a virtual simulation environment, exploring how to apply theoretical knowledge to practical problem-solving through real cases and project-based approaches, and enhancing students' practical application abilities. This teaching model under the digital background is different from traditional classrooms. It uses digital technologies such as virtual simulation to construct real civil engineering scenes, allowing students to engage in practical activities such as engineering design and construction simulation in a virtual environment, improving their understanding of civil engineering concepts and practices. This teaching method can enhance students' spatial imagination and problem-solving abilities.

Finally, innovative civil engineering practical teaching plans can be designed using modeling and simulation software. Students can design, build, and test various structures in a virtual environment to conduct practical engineering practices in a secure manner. This approach can cultivate students' practical operational skills, reduce resource waste and risks.

2.2 Exploring New Learning Paradigms Based on Personalized Learning and Collaborative Learning

Individualized learning can meet the individual needs and differences of students, stimulate their learning motivation and interest; Collaborative learning can provide opportunities for interaction and collaboration among students, promoting knowledge co construction and deep understanding[7-9].

For the research on personalized learning paradigms, it is necessary to first introduce the concept of personalized learning. Based on individual differences and learning habits of students, educational technology and data analysis methods should be used to design personalized learning models based on their interests and abilities. Customize the learning path and teaching content based on the characteristics of civil engineering courses. Design personalized learning paths based on the interests, academic background, and career goals of each civil engineering student.

Exploration of collaborative learning paradigms, explore the advantages of online collaborative learning and design a digital learning environment that supports collaboration and interaction; Students can collaborate on projects in small groups or teams, work together to solve problems, share perspectives, and help each other. This form of learning can cultivate students' communication skills, teamwork skills, and problem-solving abilities. By creating courses through online platforms, students can collaborate across regions and time to participate in the design and planning of civil engineering cases. Through digital tools, students can collaborate, communicate, and share design solutions in real-time, thereby cultivating teamwork, remote collaboration, and project management abilities, while expanding their international perspective, which is of great significance in practical engineering projects.

2.3 Research on the Effectiveness Evaluation Methods of Teaching and Learning Paradigms in the Context of Digital Education

In the context of digital teaching and learning paradigms, research is conducted to timely obtain learning feedback on student learning outcomes, motivation, and experience. Based on the feedback information, personalized and collaborative learning modes are adjusted to continuously improve teaching strategies[10-11].

Firstly, comprehensive evaluation of practical projects can not only involve students in solving real civil engineering problems, from design to construction, but also assess their professional knowledge, team collaboration, problem-solving ability, and innovative thinking through comprehensive evaluation of projects.

Secondly, real-time interactive tools such as online voting and Q&A platforms should be introduced to allow students to participate in interaction in the classroom. Through real-time interaction, teachers can quickly understand students' understanding and provide timely answers and explanations. At the same time, students can also raise questions and opinions, promote teacher-student interaction, and further optimize teaching effectiveness.

Finally, multi-dimensional evaluations such as student self-evaluation, peer evaluation, and teacher evaluation can be used to comprehensively evaluate the academic,

practical, and team collaboration performance of students, in order to comprehensively evaluate the effectiveness of teaching and learning. Utilize digital technology to reform evaluation methods and optimize the combination of empirical evaluations based on data. By utilizing intelligent teaching tools, we can digitize the teaching process, promote the close integration of evaluation and learning processes, and complete evaluations during the learning process. Through on-demand processing, multivariate analysis, precise application, and scientific evaluation, we can create a realistic "portrait" of predictable educational and teaching outcomes, making the data generated during the classroom teaching process usable and useful, promoting educational innovation, teaching improvement, and incubating new models of education and teaching for the future.

3   Promotion Strategy

One is to combine the teaching innovation of virtual simulation environment, based on key civil engineering scenarios, using virtual simulation technology to build a simulation environment, allowing students to carry out practical operations in it. Identify important civil engineering operations, such as bridge design, foundation treatment, etc., and create corresponding virtual scenes; Use virtual reality devices or simulation software to allow students to simulate actual engineering operations; Record the operational data of students in the simulation environment, such as completion time, error, etc; Analyze student operational data and evaluate their operational skills and decision-making abilities. Finally, combining data collection and analysis, collect student feedback and operational data, and analyze the effectiveness. In this process, the teaching content and design are close to the learning needs and practical applications of students. At the same time, students' innovative thinking and problem-solving abilities can be cultivated, and they can make choices based on their interests and strengths, stimulating their learning motivation and subject interest.

The second is aimed at personalized learning paradigms, this is the first step in personalized learning. Teachers can evaluate students' learning abilities, personal interests, and learning styles through methods such as questionnaire surveys, tests, and observations. Secondly, provide diverse learning resources. In order to meet the different learning needs and styles of students, teachers can introduce various learning resources, including multimedia textbooks, online teaching resources, and practical activities. Then, create flexible learning scenarios. Finally, encourage self-directed learning and reflection. The personalized learning paradigm emphasizes students' autonomous learning and reflective abilities.

Thirdly, based on online collaborative design projects, firstly, based on the platform topic, students can independently choose topics and create teams, allowing them to collaborate in completing tasks, learn from each other, and communicate with each other. Introducing peer evaluation mechanism again, allowing students to evaluate each other's learning outcomes, provide feedback and suggestions. Using online discussion platforms, encourage students to share their perspectives and experiences in the course, and promote knowledge sharing.

The fourth is the evaluation of the effectiveness of teaching and learning paradigms. In the research, innovative teaching modes such as virtual simulation environments and personalized learning and team learning paradigms are adopted, so the evaluation methods can be diversified and innovative. Firstly, through the teaching mode of virtual simulation, the simulation environment and selected civil engineering practice projects can be combined to conduct dual evaluation and analysis through professional teachers and platform data; Secondly, in terms of personalized learning and team learning, effectiveness evaluation can be conducted based on student grades and learning data; In addition, based on the characteristics of each class, real-time interactive tools can be introduced to promote interaction and immediate feedback between teachers and students. This can collect student answers and questions, answer doubts in a timely manner, provide targeted explanations, and analyze student interaction data to evaluate their level of participation and understanding.

4   Conclusions

In summary, innovation in teaching and learning paradigms is an important way to promote digital education reform and a necessary requirement for "educational digitization". On the basis of analyzing the background of educational digitization, this article focuses on exploring the construction path and promotion strategy of teaching and learning paradigms in the context of educational digitization. Innovative paradigms can transform students' learning attitudes from passive to active, fully utilize digital resources, and improve learning outcomes. Meanwhile, this innovation helps to improve the quality and efficiency of education, meet the diverse learning needs of students, promote educational equity, and ensure that every student has access to high-quality educational resources. In addition, innovative paradigms have also driven changes in educational models, such as online education and virtual classrooms, providing students with more diverse and personalized learning experiences. In short, by innovating teaching and learning paradigms, digital technology can be better utilized to promote digital education reform and inject new vitality into future educational development.

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References

1. Chen, L., Guo Y.J., Zhang W.M. (2023) The World View of "Internet plus Education": Complex System View. Chinese Journal of Distance Education, 08:7-12+24. DOI: 10. 13541/j.cnki.chinade.2023.08.001.
2. Li, P., Xue, Y. (2023) Research on the Construction Path of Digital Transformation Empowering the Smart Education Ecosystem in Universities. Journal of Higher Education, 30: 16-18+22. DOI:10.19980/j.CN23-1593/G4.2023.30.004.
3. Li, X.Y. (2023) Research on Personalized Learning Path Planning Based on Online Learning Behavior. Nanjing University of Posts and Telecommunications. DOI: 10. 27251/ d. cnki. gnjdc.2023.000957.
4. Niu, L.L., Zhang, S.P., Zhao, B.H. (2021) Exploration of Applied Undergraduate Practice Teaching Based on Information Technology - Taking Civil Engineering as an Example. Anhui Architecture, 08: 174-175. DOI: 10.16330/j.cnki.1007-7359.2021.08.080.
5. Meng, Y., Wu, Chen., Chen J. (2020) Research on the Mixed Teaching Model of Civil Engineering in MOOC Environment. Journal of Science and Education, 30:80-83. DOI: 10. 16871/j.cnki.kjwhc.2020.10.035.
6. Huang, J.X., Jin S.X. (2021) The Application of Virtual Reality Technology in Civil Engineering Practice Teaching. Journal of Science and Education, 28:77-78. DOI: 10. 16871/ j.cnki.kjwha.2021.10.025.
7. Ai X.Y., Pan, Z.D., Li J. (2022) Exploration and Practice of Online Teaching of Civil Engineering Construction Course Based on OBE Engineering Education Model. Journal of Higher Education, 07:106-109. DOI:10.19980/j.CN23-1593/G4.2022.07.026.
8. Xiong, H.Q. (2022) Construction of an online and offline integrated professional experimental teaching system based on virtual simulation. Experimental Technology and Management, 03: 5-10+25. DOI: 10.16791/j.cnki.sjg.2022.03.002.
9. Liu, C. (2023) Research on Online Learning Behavior Analysis Model Based on Big Data Environment. New Technology & New Products of China, 23: 28-30. DOI: 10. 13612/ j. cnki.cntp.2023.23.022.
10. Kozak, A., Blyznyuk, L., Knysh, T. (2023) Online Learning as a Tool for the Education System in the Context of Digitalisation. Journal of Curriculum and Teaching, 2:1-6. DOI:10.5430/JCT.V12N2P132.
11. Kristina, J. A., Helene, K.H., Sørlie, S.E. (2022) Using Digital, Universal, and Intercultural Didactics to Improve Higher Education—A Project Protocol for a Norwegian Interactive and Collaborative Improvement Study Concerning Master's Level Courses in "Theory of Science, Research Methods, and Research Ethics". Frontiers in Education, 1:13-18. DOI:10.3389/FEDUC.2022.851783.