Constructing an Evaluation System of Education and Teaching Quality in Undergraduate Colleges and Universities Based on the DICE Framework

Yuan Wu[1], Ziwei Li[2*]

1 Faculty of Accounting, Guangdong Baiyun University, Guangzhou, China

2 School of Accounting, Guangzhou Xinhua University, Guangzhou, China

***Corresponding author, E-mail: lzwlabs@outlook.com**

Abstract:

The digital transformation of education is a significant breakthrough in promoting the high-quality development of education and teaching quality in undergraduate colleges and universities. However, building an education and teaching quality evaluation system that adapts to the digital era has become an important issue that needs to be solved. Through literature combing and theoretical analysis, we explore the impact of digital transformation on the quality of education and teaching and construct a new system of education and teaching quality evaluation adapted to the digital era. It has been found that digital technology changes traditional teaching methods and learning environments and profoundly affects the connotation and evaluation standards of education quality. Based on this, this study proposes constructing an evaluation system for the quality of education and teaching in colleges and universities with the DICE framework, which covers four dimensions: digital foundation and strategy, integration and innovation, capacity building, and assessment and feedback. The system aims to comprehensively and accurately assess teaching quality, help the digital transformation of higher education, and provide theoretical guidance and practical reference.

Keywords:

Digital Transformation, Undergraduate Colleges and Universities; Quality of Education and Teaching; Evaluation System; DICE Framework

1.Introduction

Considering the recent wave of social change driven by technological innovation, data has emerged as a crucial production factor, making the digital economy a powerful engine for development. This has led to significant shifts in scientific research paradigms, various disciplines' development modes, and intelligent technology advancements. During the 2024 National Conference on Education, President Xi Jinping highlighted the importance of effectively implementing the national digitalization strategy. He emphasized the need to broaden access to high-quality educational resources and to promote lifelong learning at the public service level. This vital statement outlines the strategic direction for developing education and teaching.

The rapid development of digital technology is driving higher education to undergo unprecedented changes. Undergraduate colleges and universities are facing the challenges and opportunities brought by digital transformation, and digital tools such as intelligent classrooms, online learning platforms, and virtual laboratories have not only changed the traditional teaching methods and learning environments but also profoundly affected the connotation and evaluation standards of education quality. Constructing an education and teaching quality evaluation system for undergraduate colleges and universities adapted to the digital era has become a critical issue that needs to be solved urgently.

Scholars have conducted extensive research on the digital transformation of education. DlAO Jun-Feng et al. (2024) study of the European Union's education digitalization policy provides an essential reference for understanding the digital transformation trend in international higher education. DONG Tongqiang et al.(2024) analyze the factors affecting the digital transformation of vocational education and provide insights into the transformation of undergraduate colleges and universities. They provide insights and highlight the necessity of re-examining the connotation of education and teaching quality and constructing a new evaluation system.

In the practice of digital transformation, it is also necessary to pay attention to the challenges at the ethical and operational levels. YANG Junfen et al. (2024) study on the ethical norms of AI in education reminds us that we must fully consider the ethical challenges of digitalization when constructing a new evaluation system. Zhao Xing and Bu Yifan's (2024) discussion of the digitally empowered transformation of teaching evaluation in colleges and universities lays the theoretical foundation for related research. However, how to translate these theories into an operational evaluation system must be deeply explored. However, how to transform these theories into an operational evaluation system must be explored in depth.

Based on this, this paper aims to analyze the impact of digital transformation on the quality of education and teaching in undergraduate colleges and universities and to explore the new connotations and new standards for evaluating the quality of education and teaching in undergraduate colleges and universities. The study proposes to construct an evaluation system of educational teaching quality in colleges and universities based on the DICE framework to more comprehensively and accurately assess the quality of education and teaching in the era of digitization and provide theoretical guidance and practical references for promoting the digital transformation of higher education.

2.Theoretical Background and Research Framework

2.1 The Impact of Digital Transformation on Education and Teaching in Higher Education

Digital transformation is profoundly changing the face of education and teaching in colleges and universities. In terms of teaching mode, the application of digital technology has promoted the rise of new modes, such as blended learning and flipped classrooms, which break the time and space limitations of the traditional classroom and improve the flexibility and personalization of teaching. JIANG Shihui and ZHANG Yuyu (2024) pointed out that digital transformation promotes the open sharing of educational resources and the innovation of teaching mode. Access to learning resources has also been revolutionized, with digital libraries and online

course platforms providing students with vast learning materials, making knowledge acquisition more convenient and diversified.

Teacher-student interaction has likewise experienced a remarkable transformation. Through digital tools such as online discussion and real-time feedback, communication between teachers and students has become more frequent and in-depth, effectively improving Education and Teaching effectiveness. Ll Shuang et al. (2022) show that applying digital tools significantly improves the quality and frequency of teacher-student interaction. In terms of teaching assessment, the application of learning analytics enables teachers to grasp students' learning status more accurately and adjust teaching strategies in a timely manner. In addition, digitalization has expanded the boundaries of practical teaching. Wang Li and Gao Na (2021) emphasized that technologies such as virtual simulation experiments and remote operation provide new possibilities for practical teaching, greatly expanding the breadth and depth of practical teaching.

2.2 New Perspective on the Quality of Education and Teaching in the Digital Environment

The connotation of the quality of education and teaching is changing profoundly under the shaping of the digital environment. Personalization and autonomy of learning have become essential manifestations of the quality of education in the new era. Digital tools provide students with more opportunities for independent learning and personalized development, and the quality of education is no longer only reflected in the transfer of knowledge but also emphasizes the cultivation of students' independent learning ability and potential for personalized development. This view is supported by the study of GUO Liming et al. (2024), who emphasized that the quality of education in the digital era should focus more on students' independent learning ability.

Information literacy and digital competence are also increasingly becoming critical indicators of education quality. In this digital era, whether students have good information literacy and digital skills is directly related to their future learning and career development. XONG Xinhui (2024) points out that information literacy has become one of the core qualities of citizens in the digital era. Meanwhile, digitalization promotes the integration between disciplines, and cultivating students' interdisciplinary thinking and ability to solve complex problems has become a new dimension of education quality.

In the face of the rapidly changing digital world, cultivating innovative ability and critical thinking is more important than ever. Sing Tao (2024) emphasized that innovative ability and critical thinking are essential core literacy for students in the digital era. In addition, in the context of the rapid updating of knowledge, cultivating students' awareness and ability to learn lifelong has become an essential reflection of the quality of education.

2.3 Tension Between Traditional Evaluation Systems and the Needs of Digital Transformation

The traditional evaluation system of education and teaching quality has exposed many limitations in digital transformation. First of all, there is a pronounced lag in the evaluation indicators. Traditional evaluation indexes mainly focus on the degree of knowledge mastery, and it is difficult to reflect the emerging qualities

of students' information literacy, innovation ability, and other qualities in the digital environment. It is not possible to measure the comprehensive ability of the students comprehensively. TANG Qiao (2024) pointed out that the traditional evaluation indexes are difficult to adapt to the new requirements of the quality of education in the era of digitalization.

Secondly, the evaluation methods show singularity. Traditional evaluation primarily relies on static methods such as final exams and course papers, which are challenging to capture dynamic data in the digital learning process and cannot truly reflect students' learning performance and progress in the digital environment. Evaluation dimensions also have limitations. They often ignore emerging dimensions such as teacher-student interaction and online learning participation in digital environments, leading to one-sided evaluation results. Song Ye and Liu Shu (2024) emphasized that digital learning environments require diversified evaluation methods.

In addition, in the rapidly changing digital environment, the traditional periodic evaluation makes it difficult to reflect the dynamic changes in teaching quality in time, and the timeliness of the evaluation results has become a significant problem. The singularity of the evaluation subject also limits the comprehensiveness and objectivity of the evaluation. Traditional evaluation is mainly dominated by teachers or experts, which makes it difficult to fully utilize the advantages of multiple evaluation subjects in the digital environment and fails to comprehensively reflect the views of all parties on the quality of education and teaching. Liu Hong (2024) suggests that evaluating the quality of education in the digital era should be a process that involves the participation of multiple subjects.

These contradictions highlight the urgency of constructing a new type of education and teaching quality evaluation system. The new evaluation system needs to adapt to the digital environment's characteristics, reflect the new connotation of education and teaching quality, and overcome the limitations of the traditional evaluation system to better serve the development of higher education in the digital era.

2.4 Analytical Model for Evaluating Education and Teaching Quality in Higher Education from the Context of Digital Transformation

Evaluating education and teaching quality in colleges and universities in digital transformation presents new features and requirements. In order to better understand the relationship between digital transformation and education teaching quality evaluation, based on the DICE framework, we construct an education teaching quality evaluation system under the perspective of digital transformation from the four levels of Digital Infrastructure and Strategy (D), Integration and Innovation (I), Competence Building (C) and Evaluation and Feedback (E) four levels to construct the evaluation system of education teaching quality in universities under the perspective of digital transformation, aiming to clarify how digital transformation affects and reshapes the evaluation system of education teaching quality in universities.

The DICE framework provides a systematic perspective for analyzing the multidimensional impact of digital transformation on evaluating the quality of Education and Teaching in higher education. These four levels have close links and interactions, constituting a dynamic and cyclical system.

The Digital Infrastructure and Strategy (D) dimension is the foundation and driver of the entire framework.

It encompasses the widespread application of information technology in higher education, such as artificial intelligence, big data, and cloud computing. These technologies have changed how education is delivered and provided new tools and methods for evaluating its quality. For example, the popularization of Learning Management Systems (LMS) has made it possible to track and analyze students' learning behaviors in real-time, providing technical support for process evaluation.

The Integration and Innovation (I) dimension reflects the in-depth integration of digital technology with education and teaching. This integration is reflected in the innovation of teaching methods, such as blended learning and flipped classrooms, and the integration and sharing of educational resources. The development of Open Educational Resources (OER) and Massive Open Online Courses (MOOCs) has broken the traditional boundaries of education and provided a new dimension and frame of reference for evaluating education quality. Convergence and innovation have also promoted interdisciplinary and cross-field education models, requiring quality evaluation systems to adapt to this complex education ecology.

The Competence Building (C) dimension focuses on new competencies needed in the digital age. This includes digital literacy, information processing skills, online collaboration skills, and broader qualities such as critical thinking, innovation, and lifelong learning. Digital transformation requires an education quality evaluation system that effectively measures and assesses these competencies, challenging traditional evaluation methods. At the same time, capacity building for teachers and administrators has become critical, as they need to acquire new skills such as data analysis and instructional design to adapt to the new evaluation requirements.

The Evaluation and Feedback (E) dimension is the core output of the whole framework. Digital transformation has provided more prosperous and more accurate data sources for educational assessment, making real-time, personalized assessment possible. The application of technologies such as learning analytics and educational data mining makes assessment not limited to final exams or summary evaluations at the end of a course but formative evaluations throughout the entire learning process. This continuous assessment feedback helps students adjust their learning strategies in time and provides a basis for teachers to optimize their teaching.

The DICE framework consists of four interconnected levels that enhance each other cyclically. The digital foundation (D) offers the technical support necessary for convergence innovation (I). This innovation creates a demand for new types of competencies (C). Developing these competencies requires advancements in assessment methods (E). Moreover, feedback from assessments will stimulate further digital transformation and innovation, creating a virtuous cycle.

This framework highlights the far-reaching effects of digital transformation on assessing education quality and teaching. It has altered the tools and methods used for evaluation and the content, standards, and processes involved. Within this framework, evaluating education quality is no longer a static, one-way process; instead, it has become a dynamic, multidimensional, and continuous improvement system.

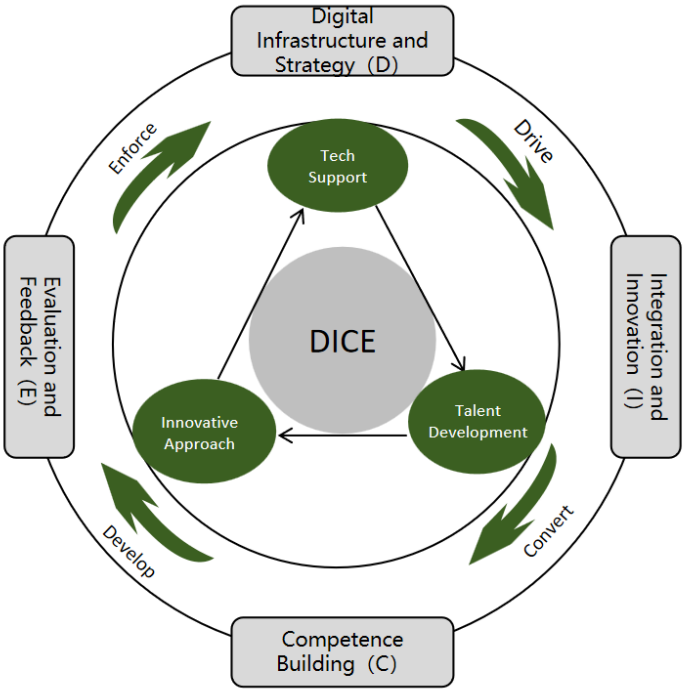

Fig 1. Framework for assessing the quality of Education and Teaching in higher education based on DICE

Understanding and applying the DICE framework can help build a more comprehensive and effective evaluation system of education and teaching quality for colleges and universities. It suggests that when promoting digital transformation, colleges and universities must pay attention to multiple aspects, such as technology application, teaching innovation, competence development, and assessment reform, to ensure that these elements can be coordinated and mutually reinforcing. At the same time, this framework also provides theoretical guidance for universities to formulate digitization strategies and quality improvement plans.

3.Characteristics of the DICE-Based Evaluation System for Teaching Quality in Higher Education

3.1 Content and Characteristics of the DICE Framework

The DICE framework is a new quality evaluation model for Education and Teaching in higher education. It comprises four core dimensions: Digital Infrastructure and Strategy (D), Integration and Innovation (I), Competence Building (C), and Evaluation and Feedback (E). These dimensions are interrelated and mutually influential, forming a cohesive system that reflects the complex impact of digital transformation on the quality of university education and teaching.

The main features of the DICE framework can be summarized as comprehensive, systematic, dynamic, balanced, and innovative. Its comprehensiveness is reflected in the framework covering all aspects, from infrastructure to pedagogical innovation and capacity development to assessment and feedback. Systematical is manifested in the close connection between the dimensions, forming an organic whole. Dynamical empha-

sizes the importance of continuous improvement and adaptation to change, reflecting the dynamic nature of education and teaching quality in the digital environment. Balance is reflected in the fact that the framework focuses on both the application of technology and the maintenance of humanistic care and traditional educational values. On the other hand, focuses on the educational innovations brought about by digitization, including teaching models and interdisciplinary integration.

3.2 Importance of the DICE Framework in Evaluating the Quality of Education and Teaching in Higher Education

The DICE framework is widely used to evaluate the quality of education and teaching in colleges and universities. It addresses the need for digital transformation and comprehensively reflects the impact of digitization on all aspects of education and teaching. This provides a systematic evaluation tool for higher education institutions.

Secondly, the framework includes quantitative and qualitative indicators, allowing it to adapt to the diverse evaluation needs of various levels and types of colleges and universities.

Moreover, by emphasizing evaluation and feedback, the DICE framework offers a mechanism for continuous improvement, helping to enhance the overall quality of education and teaching. Its focus on digital foundations and strategic dimensions gives universities the tools and direction to develop digital transformation strategies and make informed strategic decisions. Finally, by highlighting the importance of capacity building, the DICE framework assists colleges and universities in cultivating talents that meet the demands of the digital era.

3.3 Differences and Advantages Between DICE-Based Evaluation System and Traditional Evaluation System

Compared with the traditional evaluation system, the DICE-based evaluation system shows significant differences and advantages regarding evaluation perspectives, processes, and methods. In terms of evaluation perspective, the DICE framework not only focuses on traditional teaching content, teaching methods, and learning outcomes but also includes new dimensions such as digital infrastructure, integration, and innovation, which can more comprehensively reflect the complexity and diversity of teaching and learning in higher education in the digital era.

Regarding the evaluation process, the DICE framework emphasizes continuous assessment and real-time feedback rather than the stage-by-stage, static evaluation of traditional evaluation systems. This dynamic evaluation model can identify problems, adjust strategies promptly, and promote continuous improvement in education and teaching quality. The DICE framework introduces new evaluation methods, such as extensive data analysis and learning analytics, which can obtain more affluent and more objective evaluation data and improve the scientific and accuracy of evaluation.

The DICE framework pays more attention to innovation and integration, taking teaching innovation and discipline integration as important evaluation dimensions. This is conducive to promoting teaching mode innovation and interdisciplinary integration and improving the quality of education and teaching. At the same

time, the framework emphasizes the cultivation of digital literacy and innovation ability, which helps to cultivate composite talents adapted to the needs of the digital era.

In addition, the DICE framework supports personalized evaluation based on learning analytics, which can provide targeted evaluation and feedback for different learners and promote personalized learning. Finally, the framework takes the digitization strategy as an essential evaluation content, which helps to combine the evaluation of education and teaching quality with the university's development strategy and promotes overall quality improvement.

The DICE-based evaluation system of education and teaching quality in colleges and universities is more adapted to the needs of the digital era. It can comprehensively, dynamically, and accurately assess the quality of education and teaching and strongly support education and teaching reform and quality improvement in colleges and universities. This evaluation system focuses on the current quality of education and teaching and looks at future development, which helps colleges and universities maintain their competitive advantages in digital transformation.

4.Development of a DICE-Based Evaluation Index System for Assessing Teaching Quality in Higher Education.

The education and teaching quality evaluation system in higher education presented in this paper is built upon the DICE framework. It features a multilevel structure that comprises primary indicators, secondary indicators, and evaluation elements. The detailed structure of this evaluation system is illustrated in Table 1.

Table 1. Evaluation Index System of Education and Teaching Quality in Higher Education Based on DICE

Primary indicator	Secondary indicator	Specific items
D Digital Infrastructure and Strategy（25%）	D1 Digital Infrastructure（10%）	Quality of network infrastructure (D11), Smart Classroom Setup (D12), Cloud Platform Development (D13), Abundance of Digital Learning Resources (D14)
	D2 Digital Strategy（15%）	Digital Transformation Strategic Clarity (D21), Leadership Focus (D22), Digital Transformation Inputs (D23), Assessment of Digital Transformation's Impact on Education Quality (D24)
I Integration and Innovation（25%）	I1 Innovations in Teaching Models（15%）	Degree of Blended Teaching Application (I11), Adoption Rate of Innovative Teaching Modes such as Flipped Classroom (I12), Effectiveness of Innovative Teaching Modes in Enhancing Students' Interest and Engagement (I13), Balance Between Traditional and Innovative Teaching (I14)
	I2 Interdisciplinary Integration（10%）	Support for Interdisciplinary Teaching and Research (I21), Extent to Which Digitization Facilitates the Integration of Disciplines (I22), Creation of New Interdisciplinary Courses(I23), Degree of Integration of Digital Technologies with Traditional Disciplines (I24)

C Competence Building （25%）	C1 Teachers' Digital Competence（15%）	Level of Teachers' Digital Pedagogical Competence (C11), Frequency and Quality of Teachers' Digital Competence Training (C12), Teachers' Ability to Apply Digital Tools (C13), Teachers' Ability to Innovate in Digital Teaching (C14)
	C2 Student Digital Literacy（10%）	Students' Digital Literacy and Information Processing Skills (C21), Digital Literacy Curriculum Development (C22), Degree of Improvement in Students' Self-Directed Learning Skills (C23), Students' Adaptability to the Digital Environment (C24)
E Evaluation and Feedback （25%）	E1 Teaching Quality Assessment（15%）	Degree of Diversification of Digital Teaching Evaluation Methods (E11), Contribution of Digital Evaluation to Teaching Improvement (E12), Combination of Continuous and Final Assessment (E13), Timeliness and Effectiveness of Digital Evaluation (E14)
	E2 Learning Analytic & Feedback（10%）	Application of Big Data in Instructional Improvement (E21), Personalized Learning Support (E22), Construction of Real-time Instructional Quality Monitoring System (E23), Data-driven Instructional Decision Support (E24)

The selection of indicators is a crucial link in constructing the DICE evaluation system for quality education and teaching in colleges and universities. The selection of indicators is mainly based on four aspects: firstly, the selection of indicators takes complete account of the core dimensions of the DICE framework to ensure that the evaluation system can comprehensively cover the four critical aspects of digitization foundations and strategies, integration, and innovation, capacity building, assessment, and feedback. This comprehensive coverage helps to build a systematic and complete evaluation system that can assess the quality of education and teaching in universities from multiple perspectives. Second, selecting indicators fully reflects colleges' and universities' transformation needs and development trends in the digital era. By choosing indicators that can reflect the characteristics of digital transformation, the evaluation system can better adapt to the current development of higher education and guide colleges and universities toward digitization and intelligence. Third, selecting indicators always pays attention to the essence of education and teaching quality, focusing on the core elements such as teaching mode, teachers' competence, and students' quality. This ensures that the evaluation system does not neglect the essence of education due to excessive focus on technology and maintains the core focus on the quality of education and teaching. Finally, in the indicator selection process, special attention is paid to the indicators. Selecting measurable and comparable indicators ensures the feasibility of the evaluation process and the objectivity of the results, which is crucial for the practical application and promotion of the evaluation system.

Determining the importance of each indicator is reflected mainly through the allocation of weights. For example, the weight of “Digital Strategy” (15%) is higher than that of “Digital Infrastructure” (10%), which reflects the critical role of strategic planning in the digital transformation of universities. Similarly, the weight of “Innovations in Teaching Models” (15%) is higher than that of “Interdisciplinary Integration” (10%), which highlights the importance of innovative teaching modes in improving the quality of education and teaching. This weighting reflects the relative importance of each indicator and the focus of each dimension

under the DICE framework, which can help universities allocate resources and efforts in digital transformation rationally.

This scoring and calculation method can comprehensively and objectively reflect the level of education and teaching quality of universities in all aspects while motivating universities to pursue the improvement of the overall effect of digital transformation through the overall effectiveness bonus item. This evaluation system can not only quantify the quality of education and teaching in colleges and universities but also provide colleges and universities with clear directions and goals for improvement.

5.The Implementation Path of the DICE-Based Evaluation System for Assessing Education and Teaching Quality in Higher Education

With the development of digital transformation and the deepening of educational evaluation reform, constructing a DICE-based evaluation system of education and teaching quality in higher education has become an important task. This paper proposes a specific path to realize this evaluation system, including the implementation steps of the evaluation system, the strategy of data collection and analysis, the application mechanism of the evaluation results, and the possible challenges and solutions.

5.1 Specific Steps and Methodology for The Implementation of The Evaluation and Teaching System

Implementing a DICE-based evaluation system for the quality of education and teaching in colleges and universities requires a systematic approach and gradual steps. First, colleges and universities should build a data-driven evaluation framework, including multi-dimensional evaluation indicators covering the teaching process, learning effects, resource utilization, and other aspects. Second, an intelligent platform integrating data collection, storage, processing, and analysis is needed to realize real-time collection and processing of various data types in the teaching process.

In addition, colleges and universities should also focus on cultivating data literacy in evaluation subjects. Through systematic training, teachers and administrators should improve their data analysis ability, visualization techniques, and ethics awareness to interpret and apply data scientifically. Finally, evaluation should be carried out continuously and cyclically so that evaluation reports can be formed by collecting and analyzing data regularly, and improvement measures can be formulated based on the evaluation results, thus promoting the continuous improvement of teaching quality.

5.2 Strategies for Data Collection and Analysis

To enhance data collection, a diversified approach should be implemented. This includes gathering information from various sources: the intelligent classroom system for teaching process data, the learning management system for learning behavior data, feedback from questionnaires and interviews, usage statistics from the teaching resource platform, and assessments of student performance and skills. By adopting this multi-dimensional data collection strategy, we can comprehensively understand teaching quality.

For data analysis, it is essential to utilize advanced technologies such as machine learning and data mining

for in-depth examinations. These techniques can help identify potential teaching challenges, predict student learning outcomes, and support informed teaching decisions. Additionally, a robust data quality management system should be established. This system should include standardized data collection procedures, a thorough data cleaning process, and secure data storage to ensure the accuracy and reliability of the data.

5.3 Utilization of Evaluation Results and Feedback Mechanisms

The practical application of evaluation results is the key to improving teaching quality. First, teachers should be provided with personalized teaching improvement suggestions based on the evaluation results, such as recommending relevant teaching methods and resources for deficiencies in classroom interaction. Second, by analyzing the evaluation data, the weak links in the utilization of teaching resources can be identified so that teaching resources can be reasonably deployed and optimized, and the efficiency of resource use can be improved.

In addition, evaluation results can provide data support for school management to assist in formulating scientific teaching policies and development plans. Finally, combining evaluation results with teacher training and career development can help teachers formulate personal development plans and promote their professional growth. A closed-loop quality improvement system can be formed through these applications and feedback mechanisms.

5.4 Potential Challenges and Solutions During Implementation

Multiple challenges may arise when implementing a DICE-based education and teaching quality evaluation system. The first is data security and privacy protection. To this end, universities need to develop a strict data management system, adopt encryption technology to protect sensitive data, establish a system of data access rights, and conduct regular security audits.

The second challenge is the scientific and comprehensive nature of evaluation indicators. The solution is to combine quantitative and qualitative methods, establish a diversified evaluation index system, and regularly assess and update the evaluation indexes to ensure their scientific and comprehensive nature.

The third challenge is teachers' acceptance and participation. In this regard, publicity and training should be strengthened so that teachers can understand the value of data-driven evaluation. At the same time, teachers should be encouraged to participate in the design and optimization of the evaluation system to enhance their sense of ownership.

Fourth, implementing the DICE evaluation system requires strong technical support and professional talents, which may challenge some universities. The solution is to increase investment in building an advanced data analysis platform while cultivating on-campus data analysis talents and introducing external expert support when necessary.

Finally, it is also an important challenge to truly transform evaluation results into actions for teaching improvement. To this end, universities should establish a linkage mechanism between evaluation results and teaching improvement and design specific application programs and tracking and feedback mechanisms to ensure that evaluation results can promote teaching quality improvement.

By systematically addressing these challenges, colleges and universities can gradually establish and improve the DICE-based education and teaching quality evaluation system to continuously improve teaching quality and optimize educational effectiveness. This process requires the concerted efforts of all university aspects and the continuous summation of experience, adjustment, and optimization in practice, which will ultimately lead to the formation of a scientific, effective, and sustainable evaluation system.

6.Conclusions and Limitations

Higher education is facing unprecedented opportunities and challenges due to digital transformation. Based on the DICE framework, this study explores the construction of an educational teaching quality evaluation system in undergraduate colleges and universities, which provides new ideas and methods for colleges and universities to improve the quality of education and teaching in the digital era.

The DICE framework supports constructing a comprehensive, systematic, and dynamic evaluation system for educational teaching quality in colleges and universities. In the Digital Infrastructure and Strategy (D) dimension, the evaluation system makes full use of emerging technologies such as big data and artificial intelligence to realize the intelligence and precision of the evaluation process. The Integration and Innovation (I) dimension emphasizes cross-disciplinary and cross-field integration, promoting innovation of teaching modes and evaluation methods. The Competence Building (C) dimension focuses on cultivating students' core literacy and future vocational competence, making the evaluation more focused on learning outcomes and application ability. The Evaluation and Feedback (E) dimension ensures that the evaluation results can be effectively translated into concrete measures for teaching improvement.

In terms of the design of the evaluation index system, a multi-dimensional and multi-level index system is proposed based on the DICE framework. The system not only covers the traditional indicators of teaching input, process, and effect but also incorporates new types of indicators, such as the utilization of digital teaching resources, the construction of an intelligent teaching environment, the cultivation of students' digital literacy, and the teachers' digital teaching ability, which comprehensively reflects the new characteristics and requirements of higher education in the digital era.

For the implementation path of the evaluation system, the study proposes a phased implementation strategy based on the DICE framework:

1.In the digital transformation stage, universities need to improve digital infrastructure and establish a sound data collection and analysis system.

2.In the stage of integration and innovation, the deep integration of teaching and technology is promoted, and evaluation methods and tools are innovated. Again, the capacity-building stage focuses on improving teachers' digital teaching ability and students' digital literacy.

3.In the evaluation and feedback stage, a data-based continuous improvement mechanism is constructed to realize the virtuous cycle of evaluation results and teaching improvement.

However, this study has some limitations. First, the application of the DICE framework in higher education

is still in the exploratory stage, and its validity and reliability need to be verified by more empirical studies. Second, the study mainly focuses on undergraduate-level colleges and universities, and its applicability to different types and levels of colleges and universities needs further testing. In addition, exploring privacy protection and ethical issues in data collection and use is not deep enough.

Based on the above findings and limitations, future research can be carried out in the following directions: first, carry out large-scale empirical studies to verify the validity and reliability of the education teaching quality evaluation system constructed based on the DICE framework. Second, to explore in depth the interaction mechanism between the dimensions of the DICE framework, optimize the structure of the framework, and enhance its explanatory power and application value. Furthermore, research on combining the DICE framework with other advanced educational theories and evaluation methods is needed to enrich further and improve the evaluation system.

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