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Construction and Application of Teaching Quality Evaluation System under the Mathematical Intelligence Teaching Reform

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Abstract: With the advent of the digital intelligence era, reforms in digital intelligence-based teaching present new opportunities and challenges for evaluating teaching quality. This paper examines the significance of teaching quality evaluation in the context of digital intelligence teaching reform, emphasizing its role in enhancing instructional quality, supporting student development, and fostering educational innovation. A teaching quality evaluation index system is constructed, outlining evaluation objectives, defining evaluation content, and highlighting the system's key characteristics. Various evaluation methods are explored, including the establishment of interactive digital classrooms, the development of an intelligent learning resource supply system, and the application of a "digital intelligence integration" evaluation strategy. The paper analyzes the impact of digital intelligence teaching reform on teaching quality, including the provision of new tools and approaches, enrichment of instructional resources, and promotion of teachers' professional growth and instructional innovation. Finally, a teaching quality evaluation system tailored to the digital intelligence teaching environment is developed. By integrating big data and artificial intelligence technologies, an evaluation model is established based on the principles of comprehensiveness, objectivity, and scientific rigor, utilizing intelligent evaluation tools and methods. The proposed approach aims to improve teaching quality, support the holistic development of students, and drive innovative advancements in education.

Keywords: digital intelligence teaching reform; teaching quality evaluation; index system; evaluation method

1. Introduction

With the advent of the digital intelligence era, the field of education is undergoing profound and rapid transformations. Digital intelligence-based teaching reform has introduced not only new technological tools and methods but also novel paradigms for curriculum design, pedagogical strategies, and learning evaluation. These changes bring both opportunities and challenges for assessing teaching quality, demanding evaluation frameworks that are more comprehensive, adaptive, and data-driven. This paper focuses on exploring the indices, methods, and systems for evaluating teaching quality under digital intelligence teaching reform, aiming to enhance instructional effectiveness, support student-centered learning, and promote the overall development of education [1].

In the digital intelligence era, China's educational informatization has progressed from "simple application" to "deep integration," where digital technologies are no longer supplementary aids but integral components of educational processes. Digital platforms, intelligent learning systems, and real-time analytics tools provide unprecedented opportunities to capture detailed learning behaviors, monitor teaching effectiveness, and facilitate personalized learning experiences. As a result, teaching quality evaluation should expand beyond traditional assessments of academic performance to encompass

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students' comprehensive abilities, including critical thinking, creativity, problem-solving skills, collaboration, and self-directed learning capabilities.

An effective evaluation system must also emphasize process-oriented assessment, ensuring that feedback is timely, continuous, and actionable. By monitoring the teaching and learning process in real time, educators can identify gaps, adjust instructional strategies, and optimize teaching methods dynamically. Moreover, integrating big data analytics and artificial intelligence techniques enables objective, quantitative, and evidence-based evaluation, providing a foundation for both teacher professional development and institutional decision-making [2].

Ultimately, constructing a robust teaching quality evaluation system in the digital intelligence context has significant theoretical and practical implications. Theoretically, it advances the understanding of digital pedagogy, learning analytics, and instructional design under intelligent education frameworks. Practically, it supports adaptive learning environments, promotes innovation in teaching practices, and facilitates the holistic development of students, equipping them with the knowledge, skills, and competencies required to thrive in an increasingly complex, digitalized society.

2. The Importance of Teaching Quality Evaluation under the Mathematical Intelligence Teaching Reform

2.1. Improving the Quality of Teaching

The reform of digital intelligence-based teaching has brought unprecedented opportunities for enhancing instructional quality, offering abundant teaching resources and diverse pedagogical methods. By leveraging intelligent technologies such as big data analytics and artificial intelligence, students' learning behaviors can be monitored and analyzed in real time, providing teachers with precise feedback and actionable guidance. Digital intelligence technology integrated into classroom instruction reshapes the teaching quality evaluation ecosystem by establishing a hierarchical classroom evaluation index system and creating interactive, data-driven learning environments. Through strategies such as factor adjustment, model reconstruction, and instructional carrier reorganization, a systematic evaluation framework can be achieved that enables full-cycle data collection, comprehensive process tracking, and real-time assessment of teaching performance across all dimensions. This not only allows for a nuanced understanding of instructional effectiveness but also supports continuous improvement and refinement of teaching practices.

2.2. Promoting Student Development

The application of big data analysis allows educators to gain deep insights into students' learning habits, interests, and individual needs, facilitating the design of more targeted and effective instructional plans. Personalized teaching interventions enabled by digital intelligence tools enhance learning outcomes and foster the development of autonomous learning skills, creativity, and problem-solving abilities. In addition, such approaches encourage students to actively engage in social activities, promoting social responsibility, teamwork, and a sense of collective achievement. By aligning instructional strategies with students' strengths and learning preferences, digital intelligence-based teaching not only enhances academic performance but also cultivates well-rounded individuals equipped with the skills and competencies required for lifelong learning and societal contribution [3].

2.3. Supervising Teaching Work

A robust teaching quality evaluation index system provides a scientific and objective framework for educational authorities and school administrators to monitor and supervise instructional work. By quantifying both teaching processes and learning outcomes, the system offers reliable indicators of teacher performance and student

achievement. Education authorities and schools can use these metrics to guide instructional improvement, identify areas needing support, and ensure that teachers are held accountable while fostering professional growth. This data-driven supervision mechanism encourages continuous refinement of teaching strategies and promotes a culture of excellence within educational institutions [4].

2.4. Promoting Innovation in Education

Digital intelligence teaching reform offers both technological support and platform infrastructure for educational innovation. Teaching quality evaluation plays a key role in guiding educators to explore new instructional models, adopt innovative teaching methods, and enhance the overall competitiveness of educational practices. A scientifically designed evaluation system motivates teachers to experiment with novel pedagogical approaches, providing positive feedback and incentives for innovative teaching. Intelligent teaching platforms can analyze student learning data in real time, delivering personalized recommendations to teachers and helping them better address individual learning needs. Furthermore, digital intelligence teaching reform fosters cross-disciplinary and cross-regional collaboration, facilitating shared problem-solving, the co-creation of innovative teaching models, and the continuous improvement of instructional quality across diverse educational contexts.

3. Exploration of Quality Evaluation Methods under Digital and Intelligent Teaching Reform

3.1. Establishment of Interactive Digital Teaching and Learning Classrooms

The reform of blended and digital intelligence teaching emphasizes the comprehensive, efficient, and dynamic collection of digital process information to enhance instructional precision. The blended teaching model integrates mobile learning, remote collaboration, virtual laboratories, and intelligent learning spaces, creating seamless connections across different times and locations. Through historical data on students' resource access, task completion, and extended learning activities, teachers can accurately track learning dynamics, identify individual and common challenges, adjust instructional strategies, and provide targeted, personalized guidance [5].

Digital platforms enable students to expand their learning time and space, engage in real-time interaction, correct cognitive biases, and complete knowledge construction, transfer, and refinement. These practices facilitate the transformation of teaching quality evaluation from static assessment to a dynamic, interactive process. By combining evaluations from internal and external mentors, student self-assessments, and objective data, a comprehensive evaluation framework can be implemented. Classroom growth profiles are generated, producing individual process reports, value-added reports, and outcome reports for both teachers and students, measured over weekly, monthly, and semester cycles. Longitudinal comparisons of teaching and learning outcomes further support the creation of value-added profiles, promoting continuous improvement in both instructional quality and student performance.

3.2. Construction of an Intelligent Learning Resource Supply System

The development of a digital teaching resource library is crucial for achieving effective course information management. By modularizing courses, implementing project-based content, and digitalizing instructional materials, teaching resource libraries can cover all majors, programs, and courses comprehensively. Multi-form digital resources, including text, images, audio, and video, are developed to meet the diverse learning needs of students.

Digital platforms facilitate end-to-end course management, encompassing resource construction, instruction, practical exercises, homework, Q&A, teaching evaluation, and course assessment. Intelligent management platforms further enable real-time monitoring

of teaching processes, intelligent analysis of learning situations, and automated evaluation of instructional performance. Comprehensive teaching management systems serve teachers and students, internship and employment platforms monitor the quality of practical training and career outcomes, course management platforms support teaching participation, and institutional analysis platforms facilitate online administration and data governance, ensuring seamless integration of digital tools into all aspects of educational practice [6].

3.3. Application of "Digital and Intelligent Integration" Evaluation Strategies

The essence of the "digital and intelligent integration" evaluation strategy lies in using data to faithfully represent the real learning process and leveraging intelligent tools to enhance evaluation and guide value creation. Its core objective is the transformation of evaluation concepts rather than mere technological upgrades. This approach shifts from selective evaluation to developmental evaluation, and from single-score assessment to whole-person growth assessment.

To achieve effective integration, data silos must be broken down and systems interconnected. Regional education authorities can lead the formulation of standardized data interfaces, promoting interconnectivity among smart classroom systems, teaching management, learning analytics, and health monitoring, thereby preventing data incompatibility and collection gaps. Enhancing teachers' capabilities in digital and intelligent applications is essential; stratified training can be conducted, with foundational training covering data viewing and report interpretation (e.g., understanding student ability profiles), and advanced training focusing on data-driven instructional design (e.g., intervention strategies based on warning data).

Moreover, application incentive mechanisms can encourage meaningful use of evaluation results. By incorporating the impact of digital and intelligent evaluation into teacher assessments, teachers who actively apply these strategies and achieve significant improvements are recognized and rewarded, avoiding the pitfalls of formalistic "evaluation for evaluation's sake." This ensures that evaluation drives actionable insights, promotes pedagogical innovation, and supports continuous improvement in both teaching and learning outcomes.

4. Paths for Establishing a Quality Evaluation System in the Digital and Intelligent Teaching Environment

With the deep integration of technologies such as artificial intelligence and big data into education, the digital and intelligent teaching environment has become a crucial carrier for the digital transformation of instructional practices. Traditional quality evaluation systems, which focus solely on "grades," are insufficient to meet the personalized, process-oriented, and diversified teaching requirements of the digital era. Establishing a scientifically grounded and feasible evaluation system has become essential for promoting improvements in teaching quality.

4.1. Clarifying the Digital and Intelligent Evaluation Orientation is the Primary Premise

The core advantage of a digital and intelligent teaching environment lies in overcoming the traditional limitation of "emphasizing results while neglecting processes" in evaluation. In this context, evaluation orientation should shift from merely assessing "knowledge mastery" to fostering students' comprehensive literacy, higher-order thinking, and adaptive learning capabilities. This shift reflects the broader educational goal of cultivating learners who are not only knowledgeable but also capable of critical thinking, problem-solving, creativity, and collaborative engagement [7].

On one hand, the evaluation should prioritize the development of higher-order cognitive and metacognitive skills. By tracking students' engagement in problem-solving activities, innovative practices, and collaborative projects, educators can gain detailed

insights into individual learning trajectories and cognitive strategies. For instance, analyzing students' operational logic in virtual simulations, their approach to multi-step problem solving, or their contributions to online collaborative projects provides a nuanced understanding of learning processes, far surpassing the limited insights obtained from traditional final exam scores. Longitudinal tracking can also reveal growth patterns, enabling teachers to identify trends, anticipate challenges, and tailor interventions for different student profiles.

On the other hand, teachers' digital and intelligent teaching capabilities should be systematically assessed. Effective evaluation includes examining how teachers utilize smart platforms to dynamically adjust instructional strategies, optimize teaching rhythms based on real-time interaction data-such as participation rates, correctness of responses, and engagement in discussion forums-and deploy AI tutors or adaptive learning tools to provide targeted guidance. Evaluating these capabilities ensures that technology is not merely an accessory but a tool that measurably enhances instructional effectiveness. Furthermore, teachers' ability to integrate data-driven insights into lesson design, anticipate student learning difficulties, and personalize learning paths reflects the true value of digital intelligence in education.

By clarifying this evaluation orientation, the teaching quality assessment process moves beyond a narrow focus on outcomes, embracing a holistic view of both teaching and learning. It encourages continuous refinement of instructional methods, promotes evidence-based decision-making, and ultimately fosters an environment in which both students and teachers can achieve sustained growth and innovation.

4.2. Building a Data-Driven Evaluation Index Framework is the Core Step

The construction of a robust evaluation index framework is central to implementing effective teaching quality assessment in a digital and intelligent environment. The design of evaluation indices should adhere to principles of quantifiability, differentiation, and comprehensive coverage, forming a multi-dimensional, closed-loop system that integrates teaching processes, learning behaviors, and learning outcomes. Such a framework ensures that evaluation is both systematic and adaptable, providing actionable insights for instructional improvement [8].

From the teaching process perspective, indicators should reflect the depth and quality of digital intelligence integration. Examples include the "depth of intelligent tool application" and "frequency of teaching strategy adjustments," which can be captured from platform backend data such as interactive engagement logs, completion timeliness of homework assignments, discussion participation, and adaptive learning platform usage. Tracking these indicators allows evaluators to monitor instructional responsiveness and pedagogical flexibility in real time.

From the learning behavior perspective, process-oriented indicators provide insight into students' engagement, autonomy, and collaborative practices. Metrics such as "autonomous learning duration," "diversity of resource utilization," and "participation in peer evaluation" can be collected from learning logs, platform access trajectories, and digital interaction histories. These data points reveal not only the quantity but also the quality of students' engagement, helping educators identify learning patterns, strengths, and areas requiring targeted support.

From the outcome perspective, evaluation should move beyond traditional knowledge test pass rates to include indicators that reflect practical and applied competencies. Examples include the "quality of digital assignments," "cross-disciplinary practical achievements," and the ability to integrate knowledge using tools such as programming software, simulation platforms, or mind mapping systems. These indicators provide a richer picture of students' applied learning and innovation capabilities.

To accommodate disciplinary differences, differentiated indicators should be designed for various fields. For instance, science courses may emphasize "virtual experiment operation accuracy" and "precision in simulation modeling," whereas liberal arts courses may focus on "depth of online literature analysis" and "critical synthesis of digital research outputs." Such customization ensures that evaluation aligns with the specific learning objectives and pedagogical characteristics of each discipline, while maintaining consistency in methodological rigor across the entire evaluation framework.

By establishing a comprehensive, data-driven index system, the evaluation framework not only captures multi-dimensional evidence of learning and teaching effectiveness but also supports continuous refinement of instructional strategies, promotes accountability, and facilitates targeted interventions for both teachers and students.

4.3. Improving the Multidisciplinary Implementation Mechanism is an Important Guarantee

In a digital and intelligent teaching environment, effective evaluation must move beyond a single-entity approach and adopt a multi-participant model that actively involves teachers, students, educational systems, and administrators. Such a model ensures that evaluation captures a comprehensive picture of teaching and learning dynamics while fostering collaborative responsibility for instructional quality.

Teachers play a central role in this mechanism by engaging in systematic self-reflection based on evaluation data. For example, AI-generated learning risk warnings—such as a knowledge mastery rate falling below a certain threshold—can prompt teachers to adjust teaching priorities, refine lesson plans, and design targeted interventions for students who require additional support. Teachers can also monitor the effectiveness of applied teaching strategies and iteratively improve instructional approaches, enhancing the alignment between pedagogy and student needs.

Students contribute actively by providing feedback through multiple channels, including anonymous surveys, digital learning logs, and peer evaluation scores. This feedback not only reflects individual learning experiences but also provides insights into collaborative dynamics, engagement levels, and the effectiveness of teaching interventions. Encouraging student participation in the evaluation process strengthens their sense of agency and responsibility for their own learning.

Systems serve as the technological backbone of the multi-participant mechanism. Advanced algorithms automatically analyze collected data and generate intuitive visual evaluation reports, such as teacher efficacy radar charts, student ability development curves, and trend analyses of learning outcomes over time. These insights support evidence-based decision-making and allow all stakeholders to quickly identify areas requiring attention.

Administrators utilize synthesized multi-dimensional data to develop policies for teaching improvement, resource allocation, and professional development programs. By integrating insights from teachers, students, and system-generated analytics, administrators can ensure that evaluations are meaningful, actionable, and avoid the pitfalls of formality or superficial assessment.

A dynamic iteration mechanism is essential to maintain the relevance and effectiveness of the evaluation system. Feedback on the usability, clarity, and comprehensiveness of evaluation indicators should be collected each semester, allowing for continuous refinement. Moreover, the integration of emerging technologies, such as AI-assisted teaching tools and predictive analytics platforms, can further optimize evaluation indices, enhance real-time responsiveness, and ensure that the evaluation system remains timely, adaptive, and aligned with evolving educational practices.

By establishing a multidisciplinary implementation mechanism, the evaluation process becomes a collaborative, iterative, and data-driven endeavor, promoting sustained improvements in both teaching quality and student learning outcomes.

4.4. Strengthening Technical and Institutional Support is the Key to Implementation

At the technical level, it is essential to eliminate data silos within smart teaching platforms and achieve seamless integration of learning, teaching, and management data. This includes unifying disparate data sources such as classroom interaction logs, digital assignment submissions, platform access trajectories, and administrative records. Developing advanced data visualization and analysis tools is critical to transform raw data into interpretable, actionable insights. Such tools can generate dashboards, trend analyses, and predictive models that inform instructional adjustments, identify learning risks, and monitor the effectiveness of pedagogical interventions in real time.

At the institutional level, the results of digital and intelligent evaluations should be systematically incorporated into teacher assessment systems and student merit evaluation frameworks. By linking evaluation outcomes to professional development, promotion, and recognition mechanisms, educators and students are incentivized to actively engage with the evaluation process and apply the insights to improve teaching and learning practices. Concurrently, comprehensive data privacy and security policies must be implemented to clearly define the scope of data collection, storage, and usage, preventing misuse and safeguarding personal information. This ensures a secure and ethical foundation for implementing a data-driven evaluation system.

Constructing a teaching quality evaluation system in a digital and intelligent environment is inherently a dynamic and iterative process, requiring continuous refinement and adaptation. Leading with digital-first concepts, centering decision-making on robust data analytics, and fostering collaboration among multiple stakeholders—including teachers, students, administrators, and technical personnel—are all critical for success. By integrating these technical and institutional measures, the evaluation system can fully realize its guiding, diagnostic, and improvement functions, ultimately elevating teaching quality to a higher standard, promoting innovation, and supporting the holistic development of students.

5. Conclusion

In the digital intelligence era, education has undergone profound transformations, with China's educational informatization advancing from "simple application" to "deep integration." The reform of digital intelligence-based teaching presents both significant opportunities and challenges for teaching quality evaluation. This paper explores relevant evaluation indicators, methods, and systems aimed at enhancing instructional effectiveness and promoting comprehensive educational development.

The significance of teaching quality evaluation is multifaceted. First, technologies such as big data analytics and artificial intelligence enable real-time tracking and analysis of students' learning behaviors, reshaping the evaluation ecosystem and enhancing overall teaching quality. Second, evaluation provides teachers with insights into students' learning situations, facilitating the design of personalized teaching plans, fostering the cultivation of students' comprehensive abilities, and promoting their holistic development. Third, teaching quality evaluation offers scientific standards for educational authorities and institutions, allowing for the supervision of teaching practices and encouraging continuous improvement in instructional performance. Fourth, it supports educational innovation by guiding teachers to explore novel teaching models and methods, while fostering cross-disciplinary and cross-regional collaboration.

In terms of evaluation methods, interactive digital teaching classrooms can be established by deepening the blended teaching model, enabling dynamic data collection and the generation of individualized growth reports. Intelligent learning resource supply systems can be constructed to develop comprehensive digital resource libraries and promote platform integration. The "digital-intelligent integration" evaluation strategy facilitates a transformation of evaluation concepts, breaks down data silos, enables

stratified teacher training, and establishes incentive mechanisms that encourage meaningful application of evaluation results.

Establishing a comprehensive evaluation system requires following four key paths. First, clearly define the evaluation orientation, shifting from "knowledge mastery" to the development of comprehensive quality and abilities. Second, build a data-driven, multi-dimensional, and differentiated evaluation indicator framework that captures teaching processes, learning behaviors, and outcome effectiveness across various disciplines. Third, improve the implementation mechanism by adopting a "teacher-student-system-manager" multi-stakeholder model and establishing a dynamic iteration mechanism to continuously refine indicators and methods. Fourth, strengthen technical and institutional support, breaking data barriers, ensuring data privacy and security, and incorporating evaluation results into teacher and student assessment systems to incentivize application and promote sustained improvement.

Overall, the construction of a teaching quality evaluation system in a digital and intelligent environment is a dynamic and continuous process. By integrating data-driven approaches, fostering multi-stakeholder collaboration, and leveraging technological innovations, evaluation can play a central role in guiding, diagnosing, and improving teaching quality, ultimately advancing education toward a higher standard of excellence.

References

1. S. Quilter, and R. K. Weber, "Quality assurance for online teaching in higher education: Considering and identifying best practice for e-learning," In *International Journal on E-learning*, 2004, pp. 64-73.
2. S. A. Chapman, S. Goodman, J. Jawitz, and A. Deacon, "A strategy for monitoring and evaluating massive open online courses," *Evaluation and program planning*, vol. 57, pp. 55-63, 2016.
3. W. Li, "A construction of online teaching quality evaluation model based on big data mining," *International Journal of Continuing Engineering Education and Life Long Learning*, vol. 34, no. 1, pp. 1-12, 2024. doi: 10.1504/ijceell.2024.135271
4. S. Yang, Y. Dai, S. Li, and K. Zhao, "An automatic analysis and evaluation system used for teaching quality in mooc environment," In *2021 IEEE 1st International Conference on Digital Twins and Parallel Intelligence (DTPI)*, July, 2021, pp. 38-41. doi: 10.1109/dtpi52967.2021.9540117
5. N. Nasution, Y. Darmayunata, and S. Wahyuni, "Information system design for monitoring and evaluation of learning on blended learning," *Al-Ishlah: Jurnal Pendidikan*, vol. 14, no. 2, pp. 1633-1644, 2022. doi: 10.35445/alishlah.v14i2.1368
6. S. Li, Y. Gao, T. Shi, and F. Tao, "Research on online course teaching quality evaluation index system in Colleges and Universities," In *2021 International Conference on Computer Information Science and Artificial Intelligence (CISAI)*, September, 2021, pp. 1130-1134. doi: 10.1109/cisai54367.2021.00224
7. A. Greere, and F. Crozier, "Quality assurance expectations for online higher education: stepping stones to support post-pandemic decisions in Georgia," *Quality in Higher Education*, vol. 30, no. 1, pp. 29-54, 2024.
8. W. Zimmerman, B. Altman, B. Simunich, K. Shattuck, and B. Burch, "Evaluating online course quality: A study on implementation of course quality standards," *Online Learning*, vol. 24, no. 4, pp. 147-163, 2020. doi: 10.24059/olj.v24i4.2325

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