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Construction and Practice of a Dynamic Teaching Quality Monitoring System in Higher Education under the Background of Digital Transformation

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Abstract: Digital transformation has prompted the teaching model in higher education institutions to shift from the traditional offline mode to an integrated online-offline model. The diversification of teaching scenarios and the explosive growth of teaching data have put forward new requirements of "dynamicity, precision, and collaboration" for teaching quality monitoring. Most traditional universities rely on regular inspections and manual evaluations for teaching quality monitoring, which suffer from a series of problems, such as delayed monitoring, fragmented data, and untimely feedback, making it difficult to adapt to the dynamic changes of digital teaching. Combining the key requirements of digital transformation for teaching quality monitoring in universities, this paper analyzes the current shortcomings of the traditional monitoring system, explores the construction paths of a dynamic monitoring system from four aspects: data collection, analysis and early warning, feedback and improvement, and collaborative management, and proposes supporting practical guarantee measures. It aims to provide a practical reference for promoting the digital upgrading of teaching quality monitoring in universities and improving teaching quality.

Keywords: Digital transformation; Higher education teaching quality; Dynamic monitoring system; Data-driven

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1. Introduction

At present, although some universities have introduced digital tools to assist monitoring work, there are still many problems. For example, the degree of data integration is unsatisfactory, analytical capabilities are weak, and feedback mechanisms are rigid. These issues result in the monitoring system being unable to fully exert its early warning and optimization functions. In the context of higher education moving towards high-quality development, building a dynamic teaching quality monitoring system adapted to digital transformation has become an inevitable choice for universities to improve teaching management standards and ensure the quality of talent training. Based on this, this paper systematically explores the construction direction and practical strategies of the dynamic monitoring system, thereby providing support for the digital transformation of teaching quality monitoring in higher education institutions.

2. Core requirements of digital transformation for the dynamic monitoring system of teaching quality in universities

2.1. Real-time collection of full-dimensional data

In digital teaching, the teaching process generates a large volume of multi-source data, and the dynamic monitoring system must achieve the goal of "full-dimensional real-time collection". In terms of coverage, the system needs to cover all teaching links, including lesson preparation, teaching delivery, assignment arrangement, assessment, and evaluation, to avoid missing key information due to monitoring blind spots. Regarding data types, it is necessary to integrate teaching platform data, hardware equipment recording data, and manual recording data to construct a complete data chain, which provides support for subsequent analysis work. From the perspective of timeliness, technical means should be used to achieve automatic data collection and synchronous updating, thereby reducing time lag and errors caused by manual entry, and ensuring that monitoring results can timely reflect the current dynamic teaching situation [1].

2.2. Data-driven precision analysis and early warning

Traditional monitoring methods mainly rely on manual experience-based judgment, making it difficult to identify potential quality problems from massive data. In view of this, the dynamic monitoring system should possess "data-driven, precise analysis capabilities." In terms of analysis dimensions, it should not be limited to statistical basic indicators, but also further explore the relationship between the depth of teaching interaction and learning effects, and capture potential quality hazards behind the data reflection. In terms of early warning functions, quality thresholds need to be preset; once the data exceeds the set thresholds, automatic early warnings will be triggered to quickly identify abnormalities in the teaching process.

2.3. Rapid and efficient feedback and optimization mechanism

With the acceleration of the digital teaching rhythm, more stringent requirements are put forward for feedback efficiency. In this context, the dynamic monitoring system should establish a "rapid feedback and optimization mechanism." Firstly, to achieve timely feedback, the monitoring and analysis results need to be quickly pushed to relevant subjects to prevent the accumulation and expansion of problems. Secondly, to ensure the accuracy of feedback, the specific links of quality problems should be clearly pointed out, and targeted improvement suggestions should be put forward to help relevant personnel quickly determine the rectification direction. Finally, to form an optimization closed loop, the implementation of improvement measures should be tracked, and the improvement effect should be evaluated through subsequent data monitoring, thereby constructing a complete closed loop of "monitoring-feedback-improvement-re-monitoring" to ensure that quality problems can be effectively solved [2].

3. Existing shortcomings of the teaching quality monitoring system in universities

3.1. Fragmented data collection and high integration difficulty

In some universities, there is an "information silo phenomenon" in teaching quality monitoring data. On the one hand, data sources are scattered—for example, teaching platform data, academic management data, and student management data are stored in different systems with inconsistent data formats, which makes integration and analysis difficult. On the other hand, the data collection dimension is single, mostly focusing on the collection of result-oriented data, while lacking sufficient attention to process-oriented data that can reflect the entire teaching process, resulting in the monitoring being unable to fully show the actual teaching situation.

3.2. Weak analytical capabilities and insufficient early warning and prediction

In the traditional monitoring system, the data processing and analysis link is weak. In terms of analysis methods, it is mostly limited to data statistics and summarization, lacking in-depth correlation analysis and trend prediction of data, making it difficult to explore potential quality problems from the data. In terms of early warning mechanisms, a systematic

and intelligent early warning process has not been established; it mainly relies on manual regular inspections to detect problems, which leads to delays in early warnings and misses the best improvement opportunities. In terms of trend prediction, data modeling is not used to predict changes in teaching quality; it can only passively respond to existing problems and cannot intervene in potential risks in advance.

3.3. Rigid feedback mechanism and incomplete improvement closed loop

The feedback and optimization link is difficult to match the needs of dynamic monitoring. In terms of feedback timeliness, monitoring results are mostly summarized and fed back at the end of the month or semester, which cannot timely guide the improvement work in the teaching process, thereby allowing problems to continuously affect teaching effects. In terms of feedback content, it mostly consists of vague conclusionary expressions, failing to clearly point out specific problems and improvement directions, making it difficult for teachers to adjust teaching strategies in a targeted manner. From the perspective of improvement tracking, there is a lack of effective tracking mechanisms for improvement measures, making it impossible to evaluate the improvement effect; some problems recur, forming an ineffective cycle of "monitoring-feedback-no improvement" [3].

3.4. Insufficient multi-subject collaboration and low management efficiency

The lack of a collaborative management mechanism limits the monitoring effect. Information asymmetry, differences in monitoring data obtained by various subjects, leads to unclear improvement directions. Communication costs are high; most use traditional methods such as offline meetings and emails to exchange monitoring results, which are not only inefficient but also prone to information errors, making it difficult to quickly form a consensus on improvement. Responsibility definition is vague; the specific responsibilities of each subject in the monitoring process are not clearly defined. When quality problems arise, subjects are likely to shirk responsibility, resulting in the difficulty in implementing monitoring measures.

4. Construction of a dynamic monitoring system for teaching quality in universities under digital transformation

4.1. Establish a full-dimensional data collection system to break data silos

Comprehensive and real-time collection of teaching data should be achieved through technical integration. Construct a unified data platform to integrate data from multiple sources such as teaching platforms, academic management systems, and student management systems. Formulate standardized data formats and transmission protocols to realize automatic synchronization and associated storage of data, reducing errors caused by manual intervention. Expand data collection dimensions: on the basis of traditional result-oriented data, focus on collecting process-oriented and feedback-oriented data to build a complete teaching data chain. In addition, intelligent collection technologies should be adopted, such as IoT devices and AI analysis tools, to achieve automatic data collection, reduce manual entry links, and improve the efficiency and accuracy of data collection. For example, in process-oriented data collection, data from classroom interaction platforms can be accessed, and data such as teacher lesson plan updates and homework correction traces can be synchronously collected to ensure that the data chain covers the entire "teaching-learning-evaluation" scenario [4].

4.2. Build a data-driven analysis and early warning module to improve monitoring precision

An intelligent analysis and early warning mechanism should be established relying on digital technologies. In terms of analysis models, multi-dimensional teaching quality analysis algorithms should be designed using big data technology. These algorithms can not only analyze individual indicators but also explore potential quality problems through methods such as correlation analysis and cluster analysis. Regarding early warning settings, hierarchical early warning thresholds should be set for different indicators based on teaching quality standards and historical data; once the data reaches the

threshold, the system will automatically push early warning information to relevant subjects through multiple channels. From the perspective of trend prediction, machine learning algorithms should be used to analyze historical teaching data, predict future changes in teaching quality, and put forward intervention suggestions in advance to support management decision-making. Early warning levels can be refined into "mild-moderate-severe": for example, a student satisfaction rate below 80% triggers a mild warning, and below 70% triggers a moderate warning, with differentiated intervention plans matched to different early warning levels.

4.3. Improve the rapid feedback and optimization mechanism to form a closed-loop management

Digital methods can effectively improve feedback efficiency and improvement results. In the feedback push link, analysis results and early warning information should be transmitted to corresponding subjects in real time, accompanied by data visualization charts to help relevant personnel quickly grasp the key points of the problem. In terms of improvement suggestions, the system should automatically generate improvement directions based on data analysis to provide clear guidance for teaching adjustments. In the tracking and evaluation link, an improvement measure tracking module should be built, requiring teachers to submit improvement plans and implementation status online. The system evaluates the improvement effect through subsequent data monitoring and incorporates the evaluation results into the teaching quality file, thereby forming a complete optimization process. Feedback content can be customized for different subjects: for example, pushing "chapters with high error rates in student homework" to teachers, and "concentrated warning issues across multiple courses" to departments. A time limit for improvement should be set during tracking and evaluation; if the target is not met within the time limit, the feedback will be escalated to the school level.

4.4. Construct a multi-subject collaborative management platform to improve management efficiency

Building an integrated collaborative platform can achieve efficient collaboration among multiple subjects. From the perspective of data security, different data usage permissions should be set according to the responsibilities of each subject, and technical means such as data encryption and access log recording should be used to avoid information leakage. In terms of communication functions, the platform should have built-in functional modules such as online discussion areas, video conferences, and file sharing to support real-time communication among various subjects around monitoring results, thereby reducing the costs associated with offline communication. From the perspective of assessment and incentives, the monitoring responsibilities and task lists of each subject should be clarified on the platform, and the effectiveness of collaborative management should be incorporated into the performance appraisal system to fully mobilize the enthusiasm of each subject to participate (**Table 1**).

Table 1. Construction of a dynamic monitoring system for teaching quality in universities under digital transformation

Construction Dimension	Core Content
Full-Dimensional Data Collection System	1. Build a unified data platform, integrate multi-system data, and formulate standard formats; 2. Expand collection dimensions, including result-oriented, process-oriented, and feedback-oriented data; 3. Adopt intelligent technologies for automatic collection to reduce manual errors
Data-Driven Analysis and Early Warning Module	1. Construct multi-dimensional analysis algorithms to explore potential quality problems; 2. Set hierarchical early warning thresholds according to standards and automatically push warnings; 3. Use machine learning to predict quality trends and put forward intervention suggestions
Rapid Feedback and Optimization Mechanism	1. Real-time push of analysis results + visualization charts to help grasp key points; 2. The system automatically generates improvement directions to guide teaching adjustments; 3. Build an improvement tracking module to evaluate effects and incorporate them into quality files
Multi-Subject Collaborative Management Platform	1. Set data permissions according to responsibilities and ensure security through encryption and logs; 2. Built-in communication functions to reduce communication costs; 3. Clarify monitoring responsibilities and incorporate collaborative effectiveness into performance appraisal

5. Practical guarantee measures for the dynamic monitoring system of teaching quality in universities

5.1. Improve institutional standards and standardize system operation

The standardized operation of the system is based on the establishment and improvement of institutions and standards. Formulate data management specifications to clearly define the scope, format requirements, storage periods, and safety management rules of data collection, ensuring that data collection and use comply with regulatory requirements. Issue monitoring indicator standards: combined with the school's positioning and professional characteristics, formulate evaluation criteria and early warning thresholds for core teaching quality indicators to avoid inconsistent evaluation standards and arbitrary operations during monitoring. Establish an assessment and incentive system: incorporate teachers' participation in monitoring and improvement work and departments' monitoring and management effectiveness into the assessment scope. Publicly commend individuals and units with outstanding performance; supervise and require rectification for those who fail to implement monitoring requirements to ensure the effective operation of the entire system.

5.2. Strengthen technical support and improve system performance

Solid technical support is the guarantee for the dynamic monitoring system to exert its effectiveness. In terms of system development and upgrading, cooperation should be carried out with professional technical teams to develop a dynamic monitoring system that meets the school's needs. The system should have key functions such as data integration, intelligent analysis, and collaborative communication, and be updated and upgraded regularly to adapt to new scenarios of digital teaching. In terms of technical talent training, a school-level technical support team should be established to be responsible for system maintenance, data processing, and technical training. At the same time, technical liaison personnel should be trained for each department to assist in solving daily technical problems.

5.3. Enhance teachers and students' participation and improve system recognition

It is necessary to strengthen publicity and guidance: through channels such as the school official website, teaching seminars, and freshmen training, convey the goals and significance of the dynamic monitoring system to teachers and students, clarify that monitoring data is used to improve teaching rather than merely for evaluation, thereby eliminating teachers and students' resistance to "monitoring". Encourage teachers and students to participate in design: extensively solicit opinions from teachers and students during the system construction to ensure that monitoring indicators and improvement suggestions meet the actual needs of teaching. Open up feedback channels: provide convenient feedback channels for teachers and students, timely collect their usage experience and improvement suggestions on the monitoring system, and continuously improve the system's functions.

6. Conclusion

Under the background of digital transformation, building a dynamic monitoring system for teaching quality in universities has become an inevitable requirement to improve teaching quality and promote teaching reform. At present, the traditional monitoring system has a series of problems, such as fragmented data, weak analytical capabilities, rigid feedback mechanisms, and insufficient collaboration. These problems need to be gradually solved through full-dimensional data collection, data-driven analysis and early warning, rapid feedback and optimization, and multi-subject collaborative management. In the future, with the in-depth application of artificial intelligence and big data technologies, the dynamic monitoring system for teaching quality in universities will develop in the direction of "more intelligent, more precise, and more collaborative", thereby realizing dynamic and personalized management and control of teaching quality and providing strong support for improving the quality of talent training in universities.

Disclosure statement

The author declares no conflict of interest.

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