Construction of Teachers Performance Evaluation Index System for Data-Driven Smart Classrooms in Secondary Schools

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Abstract. Smart classroom is a new teaching paradigm for the digital transformation of education, which utilizes methods such as audio and video intelligent recognition, model construction, and data mining to evaluate teaching effectiveness and quality, in order to achieve automatic and full process evaluation and feedback of teacher teaching quality. This article is based on the massive real-time audio and video data generated by smart classrooms. By mining the hidden patterns and values of educational and teaching data, and using the Delphi method to construct a data-driven performance evaluation index system for secondary schools smart classroom teachers, it can fully reflect the real performance of secondary schools teachers in the smart classroom, achieving a comprehensive, all staff, fair, and objective evaluation of secondary schools teachers, overcoming the shortcomings of traditional evaluation methods.

1. Introduction

In the context of the digital transformation of education, vigorously promoting the construction of smart classrooms is the trend, and smart classrooms have become an important direction of current education reform. The traditional teaching quality evaluation model and methods for secondary schools teachers face many challenges and problems, such as inconsistent standards, incomplete listening evaluation, and low student participation. Therefore, guided by modern educational technology and learning construction theory, based on the massive real-time audio and video data generated by smart classrooms, using methods and means such as audio and video intelligent recognition, model construction, data mining, and teaching analysis to evaluate teaching effectiveness and quality, achieving automatic and full process evaluation, feedback, and intervention of teaching quality, and solving the difficulties and blind spots in traditional teaching evaluation, Exploring the evaluation laws of secondary schools education in new smart classrooms is particularly important. Among them, how to construct a performance evaluation index system for secondary schools smart classroom teachers is the cornerstone of achieving a comprehensive, all staff, fair, and objective evaluation of teachers.

2. Analysis of the current situation of teachers performance evaluation of traditional secondary schools classrooms

At present, the evaluation of teachers in secondary schools usually adopts methods such as school leaders attending classes, school supervision attending classes, subject teaching and research groups attending classes, and teachers listening to each other. Then, weighted statistics are used to obtain the scores of each teacher. In summary, the current evaluation methods for listening to lectures have the following problems to varying degrees:

(1) Inconsistent standards: Different supervisors may have different understandings and evaluation criteria for teaching quality, resulting in a lack of fairness and impartiality in the evaluation results.

(2) Lack of continuity: Supervised attendance is usually only a one-time evaluation, lacking continuous follow-up and long-term feedback mechanisms.

(3) Utilitarian tendency: Due to the linkage between the results of supervision and the assessment, professional title, position, and remuneration of teachers, it may lead to teachers overly focusing on the results of supervision and evaluation and adopting behaviors that violate teaching laws, but neglect the essence of education and the needs of students.

(4) Lack of student evaluation: Students often do not give sufficient attention and utilization to the evaluation of teaching quality, and lack genuine feedback from all students, resulting in biased evaluation levels.

(5)Formalization is heavy: In the supervision process, too much emphasis is placed on superficial forms,

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turning normal teaching into performance and acting classes, ignoring the real teaching process and effects, such as the teacher's educational philosophy, teaching design, and student growth records.

3. The purpose of evaluation for teachers performance in smart classrooms in secondary schools

The purpose of evaluating the performance of secondary schools smart classroom teachers is to provide more accurate and comprehensive evaluation and feedback through technological means, promote the reform of teaching quality evaluation methods in secondary schools smart classrooms, transform traditional manual methods and semester end evaluation of teacher teaching quality into automatic and full process evaluation, and promote the improvement of teacher teaching quality and student learning effectiveness. Specifically, the purpose of evaluating the performance of secondary schools smart classroom teachers includes the following aspects:

(1) Improving teaching quality: By evaluating the performance of teachers in smart classrooms, problems and shortcomings in teaching can be identified, which helps to adjust teaching strategies in a timely manner, provide targeted support and training, and help teachers improve teaching methods and enhance teaching effectiveness.

(2) Promoting Teacher Growth: Evaluation can help teachers recognize their teaching strengths and weaknesses, guide them in self reflection and professional growth, and motivate them to continuously improve their teaching abilities and levels.

(3) Stimulating Teacher Motivation: Evaluating teacher performance can serve as an incentive mechanism to give recognition and rewards to outstanding teachers, motivating them to perform better in smart classrooms.

4. Construction of teachers performance evaluation index system for smart classrooms in secondary schools

According to relevant literature research, Huang Zhongtang has constructed a secondary schools geography intelligent classroom teaching evaluation system based on the cultivation of geographical core literacy, from the aspects of teaching design, teaching process, and application of teaching results[1]; Yao Suhua and others proposed four aspects: collaborative precision teaching, intelligent evaluation techniques, personalized independent evaluation, and interactive feedback effectiveness, to construct a unique smart classroom evaluation model[2]; Huang Wendeng et al. constructed an evaluation dimension for intelligent classroom teaching in university physics from the perspective of deep learning, and designed an evaluation index system for the quality of intelligent classroom teaching in university physics[3]; Based on the combination of process and outcome, Yang Beiyi constructs an evaluation index system for vocational college English smart classrooms from the aspects of smart teaching environment, pre class teaching preparation, in class teaching activities, post class expansion reflection, and teaching effectiveness presentation, reflecting the characteristics of diverse evaluation subjects and diverse evaluation contents[4]; Zhang Qiwei and others explored the application characteristics of smart classrooms and constructed a teaching evaluation index system for management classrooms using the Analytic Hierarchy Process[5]; Secolsky, C. et al. provided a practical manual on the establishment of higher education evaluation systems and how to effectively evaluate them[6]; Rosa et al. conducted video analysis on the teaching quality of teachers in higher education through examples, aiming to promote the professional development of university teachers[7].

From the teaching practice of a smart classroom in a secondary schools in Chongqing for many years, the performance of smart classroom teachers directly affects students' academic performance and further affects the effectiveness of talent cultivation in the school. Therefore, in order to explore the evaluation laws of secondary schools education in the new smart classroom and achieve a comprehensive, all staff, fair, and objective evaluation of teachers, it is necessary to establish a scientific and reasonable performance evaluation index system for secondary schools smart classroom teachers.

4.1. Clarification of indicator selection principles

The selection of performance evaluation indicators for secondary schools smart classroom teachers should fully listen to the opinions of teachers and students, ensure the scientificity and impartiality of the evaluation indicators, and achieve the goal of promoting the improvement of teaching quality. Usually, the following principles should be followed:

(1) Teaching objective directionality: Evaluation indicators should be closely related to teaching objectives and school education quality standards, and can reflect the situation of teachers achieving teaching objectives in smart classrooms.

(2) Suitable for intelligent recognition of audio and video: There are many and wide evaluation indicators for the performance of secondary schools smart classroom teachers, such as their language expression ability, teaching content coverage, classroom interaction effect, teaching method diversity, student participation and focus, classroom management ability, etc. However, some indicators cannot be achieved using intelligent recognition technology of audio and video, so such evaluation indicators must be deleted, The retained evaluation indicators need to have clear operability, be able to be automatically observed and measured by audio and video, and facilitate evaluation and feedback.

(3) Reflecting individual differences: Evaluation indicators should take into account the individual differences and professional strengths of different teachers, avoid a one size fits all evaluation standard, and fully reflect the characteristics and styles of different teachers.

(4) Pay attention to student learning outcomes: Evaluation indicators should focus on the impact of teachers on student learning outcomes in smart classrooms, such as student learning enthusiasm, participation, and completion of classroom exercises, to ensure that the ultimate goal of evaluation is to improve student learning outcomes.

4.2. Preliminary drafting of evaluation index system

The evaluation objects of secondary schools smart classrooms are divided into teachers and students. This article only studies the teacher object. Based on defining the principles of selecting evaluation indicators and combining with the relevant requirements of the Ministry of Education for the teaching quality of secondary schools smart classrooms, a preliminary evaluation index system for secondary schools smart classroom teachers is proposed on the basis of thorough research.

The initial evaluation index system consists of 7 primary indicators (teachers' morality and style, teaching attitude, curriculum ideological and political education, teaching content, teaching methods and means, teaching effectiveness, and student-centered) and 21 secondary indicators.

4.3. Consultation of expert opinions

Using the Delphi method, the initial evaluation indicators were anonymously surveyed by different teaching experts. Based on the feedback of experts, the evaluation indicators were continuously revised, resulting in a set of consensus formed by experts on the performance evaluation index system for secondary schools smart classroom teachers. The specific steps are as follows:

(1)Expert selection: Invite experts with rich educational and teaching experience and in-depth understanding of smart classrooms to participate, including educators, middle school leaders, middle school teachers, educational technology experts, etc.

(2)Preparation of questionnaire: Based on the objectives and scope, prepare an initial questionnaire that provides a specific description of the evaluation indicators.

(3)Expert evaluation: Send the questionnaire to the experts and ask them to evaluate and rate the importance and applicability of each indicator.

(4)Statistics and Analysis: Evaluate the results of statistical experts, summarize the scores of various indicators, calculate the average score and standard deviation of each indicator, and then provide feedback to the experts for further discussion and adjustment.

(5)Multiple rounds of evaluation: Based on expert feedback, modify and improve the questionnaire, and then resend it to the experts for 2-3 rounds. During this period, experts can see the opinions of other experts and make corresponding adjustments until consensus is reached or tends towards consensus.

(6)Determination of indicators: Based on the results of expert evaluation, the indicators are screened and sorted, retaining the most representative and important indicators to form the final evaluation indicator system, including 5 primary indicators and 13 secondary indicators, as shown in Table 1.

Table 1. A evaluation index system of teachers performance for secondary schools smart classroom

primary indicators	secondary indicators	the meaning of indicators	quantitative methods for indicators	automatic recognition method for audio and video
teachers' morality and style	no words or actions that do not match the identity of a secondary schools teacher	no words or actions that do not match the identity of a secondary schools teacher	the automatic recognition system raises doubts and is ultimately recognized by the relevant departments of the school. full score of 100 points. if there is a violation of professional ethics and conduct in any class, 100 points will be deducted and one vote will be rejected	keyword matching and manual identification
teaching attitude	no lateness	not arriving in the classroom for more than 2 minutes is considered late	full score of 100 points, 10 points deducted if late for each class	face recognition algorithm
	no early departure	leaving the classroom more than 2 minutes early is considered leaving early	full score of 100 points, deduction of 10 points for early departure in each class	face recognition algorithm
	no absences	absence of 45 minutes or more in class	full score of 100 points. if there is more than one missed lesson in each class, 41 points will be deducted and recorded as a teaching accident	face recognition algorithm

	no answer calls	no answer calls	full score of 100 points, 10 points deducted for each phone call answered in each class	telephone answering recognition algorithm
	no prolonged sitting	sitting alone in a chair for more than 2 minutes while students are doing exercises or practical operations is considered prolonged sitting	full score of 100 points, 5 points deducted for each prolonged sitting in each class	sedentary recognition algorithm
	classroom management	failure to manage unproductive behaviors of students in the classroom (such as sleeping, playing with phones, taking breaks, eating, etc.) for more than 2 minutes	full score of 100 points. if each student shows one unproductive performance in class, the teacher will deduct 5 points and accumulate them	keyword matching
teaching content	curriculum ideological and political education	reflecting ideological and political content in the teaching process	full score of 100 points. if there are no ideological and political elements in each class, 5 points will be deducted	keyword matching
	clarification of teaching objectives or key and difficult points	clear presentation of learning objectives or key and difficult points	full score of 100 points. if the learning objectives or key and difficult points are not clearly stated in each class, 5 points will be deducted	keyword matching
teaching method	interactive questioning between teachers and students	teachers assess students through questioning	full score of 100 points. if there is no interactive questioning between teachers and students in each class, 5 points will be deducted	student standing recognition algorithm
	blackboard-writing	writing on blackboard, whiteboard, ppt, etc	full score of 100 points. if there is no blackboard writing in each class, 5 points will be deducted	teachers face recognition algorithms such as blackboards
	tour lecture or tour inspection	tour lectures or observe students' problem-solving and practical exercises	full score of 100 points. if there is no lecture or observation during each class, 5 points will be deducted	recognition algorithm for teacher tour teaching
students-centered	teacher discourse ratio	teacher discourse ratio	full score of 100 points. if the teacher's speech ratio exceeds 80% or more in each class, 10 points will be deducted	recognition of teacher discourse proportion

5. Conclusion

Based on the massive real-time audio and video data generated by smart classrooms, the evaluation index system constructed in this article is used to evaluate teaching effectiveness and quality through methods and means such as audio and video intelligent recognition, model construction, data mining, and teaching analysis. Firstly, the hidden laws and values of educational and teaching data can be excavated, which can not only evaluate the teaching quality of teachers, but also their teaching attitude; Secondly, it is possible to automatically raise any doubts that violate the professional ethics and conduct of secondary schools teachers in the classroom at any time, and submit them to the relevant departments of the school for verification and recognition, and handle them as appropriate; Thirdly, it can automatically detect whether all teachers have implemented ideological and political content in any class; The fourth is to achieve automatic and comprehensive evaluation, feedback, and intervention of teacher teaching quality, in order to solve the difficulties and blind spots in traditional teaching evaluation.

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