Research on the Framework of Classroom Teaching Evaluation Enabled by Artificial Intelligence Technology

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Abstract: *As a powerful technology driving force, artificial intelligence has promoted the innovation, reform and upgrade of classroom teaching. Carrying out classroom teaching evaluation supported by artificial intelligence technology can assist to carry out intelligent evaluation efficiently, probe the dynamic change of emotional information, carry out accurate collection of real class, and restore the track of teacher and student growth. Firstly, this paper combs the current classroom teaching evaluation methods and their limitations, and points out that the characteristics of real time and multi-scene evaluation should be considered in the evaluation. By summarizing previous studies, this paper points out the advantages of artificial intelligence technology enabling classroom teaching evaluation, analyzes the classroom teaching tasks and teaching performance of teachers and students in three classroom links before, during and after class in a general scenario, and extracts the data types presented under the corresponding teaching links. Moreover, it designs and summarizes the dimensions of classroom teaching evaluation with AI technology, which point to classroom language analysis, classroom behavior analysis and classroom emotion analysis. On this basis, it constructs the evaluation framework of classroom teaching with AI technology empowerment, and puts forward four suggestions for future development. This study provides a reference for carrying out intelligent and comprehensive teaching evaluation. However, in the future, the in-depth development and wide application of classroom teaching evaluation under artificial intelligence still need to explore more professional, personalized and developmental evaluation methods.*

Keywords: *Artificial intelligence; Technology enablement; Classroom teaching evaluation; Educational evaluation; Technology enabling education*

1. Introduction

With the development of education digitization, artificial intelligence, as a science[1] of researching, designing and developing intelligent systems for simulating, extending and expanding human intelligence, has been applied more and more in the field of education in recent years, including learning assistants, learning path planning and learning resource recommendation, which has exerted certain influence on education and teaching. The traditional educational theory is no longer enough to support the current educational phenomenon. Classroom teaching evaluation is an activity[2] that teachers carry out to collect and analyze students' learning information in order to judge students' learning situation, understand their teaching effect, promote students' effective learning and improve their teaching methods. As an important link in the educational theory system and a key link affecting the quality of classroom teaching, the evaluation method and technology need to be reformed, and artificial intelligence technology provides a new idea and method for the evaluation of classroom teaching. In 2020, the General Plan for Deepening the Reform of Educational Evaluation in the New Era issued by the CPC Central Committee and The State Council also clearly proposed that it is necessary to "make full use of information technology to improve the scientific, professional and objective of educational evaluation", "innovate evaluation tools, and make use of modern information technologies such as artificial intelligence and big data." Explore and carry out longitudinal evaluation of the whole process of students' learning in all grades, and horizontal evaluation of all elements of morality, intelligence, physical fitness, the United States and labor"[3]. Therefore, actively exploring the integrated development of artificial intelligence and educational evaluation is an inevitable measure for the development of intelligent education in China. Trying to carry out classroom teaching evaluation under artificial intelligence will help to enrich the evaluation content, change the evaluation method, and promote the education

evaluation to the direction of real-time, professional and comprehensive evaluation.

Based on this, this study will explore how to carry out classroom teaching evaluation based on artificial intelligence technology, and analyze the application advantages of artificial intelligence technology in classroom teaching evaluation from the perspective of learners and teachers, explore classroom teaching tasks under general scenarios, and analyze the classroom teaching performance of teachers and students enabled by artificial intelligence technology and the dimensions of classroom evaluation. And initially build a classroom teaching evaluation framework supported by artificial intelligence technology, aiming to provide a scientific and systematic evaluation method for the application of artificial intelligence technology in classroom teaching, in order to provide a reference for the evaluation of classroom teaching in the intelligent era.

2. Literature review

2.1 Current classroom teaching evaluation methods and limitations

Classroom teaching evaluation is based on teachers' teaching and students' learning in the classroom, focusing on improving teachers' classroom teaching behavior and improving the quality of classroom teaching, and evaluating[4] the design, process and results of classroom teaching. Therefore, the evaluation of classroom teaching is aimed at the process of multi-subject cooperation, collecting corresponding information for value judgment and analysis, in which feedback is an important link. At present, classroom teaching evaluation methods can be summarized into two kinds, one is the classification system used by a few people to collect classroom teaching information, the other is the evaluation criteria and indicators that most people choose to study. Generally, classroom teaching evaluation includes two stages: the collection of classroom information and the analysis and evaluation of the collected information, while the collection of classroom teaching information is generally obtained directly by observation or indirectly by using questionnaires or scales. All along, the research and development of classroom teaching evaluation in China has been influenced by environment, technology and instrumental rationality, and more emphasis has been placed on evaluation means and results. The evaluation process mainly relies on teachers' subjective observation and experience judgment, and relatively ignores the educational and developmental value[5] of evaluation, which neither makes effective use of teachers' wisdom nor provides effective immediate feedback. At present, the research on classroom teaching evaluation is still less concerned with the evaluation model of classroom teaching.

2.2 The advantages of artificial intelligence enabling classroom teaching evaluation

At present, the research of AI-enabled teaching evaluation mainly focuses on three aspects: first, the construction of corresponding theories, concepts, evaluation system and the discussion of future changes. The second is the design and technology development of artificial intelligence teaching evaluation system and tools. The third is about the application of artificial intelligence teaching evaluation, which is mainly manifested in the monitoring of students' cognitive and emotional states. Driven by artificial intelligence technology, the main body, content, methods, results and other aspects of classroom teaching evaluation will be changed. However, the integration of artificial intelligence technology into education and teaching evaluation still needs guidance at the method and technical level, but its advantages can be reflected in the following aspects:

2.2.1 Improve the accuracy and objectivity of evaluation

AI technology can improve the evaluation accuracy of classroom education by identifying aspects such as students' performance in different subjects, language expression and thinking patterns. Under the traditional evaluation methods, the contents evaluated by teachers are sometimes too one-sided and subjective, and the evaluation results may not be completely accurate. Relying on the data mining, high-speed calculation, automatic analysis and other functions of artificial intelligence, more personalized and scientific evaluation criteria can be established for each student to assist the efficient development of evaluation work, and students' performance can be evaluated and analyzed more carefully through data analysis and model prediction and other methods to record the dynamic changes of emotional information. To achieve accurate collection of real classes, in order to track the growth trajectory of teachers and students.

2.2.2 Promote the optimization of teaching process

Artificial intelligence technology can monitor and analyze the interaction, teaching content, student

learning status and other aspects of the teaching process in real time, and correct and optimize the problems, so as to provide personalized feedback information for teachers and help them better cooperate with the learning and growth of students. For example, Huang Tao and other scholars[6] have designed a human-computer collaborative teaching division of primary school Chinese writing, that is, teachers understand the learning situation and publish tasks, and machines collect data and recommend personalized knowledge and resources.

2.2.3 It can meet the needs of educational score system reform and content diversity

In different regions, different types and different stages of schools, students learn different content and assessment systems are different, the traditional classroom teaching evaluation methods are not comprehensive enough, and artificial intelligence technology can formulate evaluation content, methods and standards according to different students' needs, and generate different prediction models according to different examination systems, to improve the scientific and reliability of evaluation. For example, Li Yan and other scholars[7] have applied human-computer collaborative composition evaluation in junior middle school Chinese teaching. The machine is responsible for online evaluation and feedback on the low-level tasks such as punctuation errors and grammar errors in students' Chinese compositions, while the teacher is responsible for the high-level tasks of supplementary evaluation and feedback such as conception and meaning.

3. The construction of classroom teaching evaluation framework enabled by AI

3.1 Analysis of classroom teaching tasks and data presentation types in general scenarios

In the general teaching scenario, the design process of classroom teaching mainly includes three links before class, during class and after class, and classroom teaching activities are mainly composed of teachers' teaching and students' learning. Therefore, this study divides classroom teaching into three links: pre-class, classroom and after-class, and divides the tasks of each link, as shown in Table 1. Focusing on the two evaluation objects of teachers and students, it summarizes and extracts the data presented in the corresponding teaching links, providing the underlying basis for the classroom teaching evaluation supported by artificial intelligence technology. After summary, data types can be summarized into two categories. One is explicit materials, including text, pictures, videos, etc.; The other is invisible signals, including body signals such as language, voice, posture, expression and physiological signals, as shown in Table 1.

Table 1 Classroom teaching tasks and data presentation types in general scenarios

Evaluation object	Teaching link	Teaching tasks	Types of data presentation
Teachers	Before class	Publish the corresponding study task list, provide the guide material, etc	Text
	Class	Teacher teaching, interaction, application of classroom resources, mastering the pace of class, emotional regulation, etc	Language, voice, posture, expression, physiological signals
	After Class	Mark homework, problem marking, group evaluation, feedback, etc	Text
Students	Before class	Complete a study task list based on the material given by the teacher	Text
	Class	Attend classes, have synchronized interactions with teachers, self-regulate, and apply learning resources	Language, voice, posture, expression, physiological signals
	After Class	Finish the appropriate homework	Text

3.2 Dimension design of classroom teaching evaluation enabled by artificial intelligence technology

The evaluation of classroom teaching enabled by artificial intelligence technology is to use artificial intelligence technology to analyze the big data of the learning process and give real-time feedback to students' learning situation[8]. In the aspect of knowledge imparting, online monitoring and real-time evaluation of students' learning process can be realized through artificial intelligence technology; In

terms of homework feedback, artificial intelligence technology can be used to automatically correct and evaluate students' homework; In terms of learning feedback, artificial intelligence technology can provide personalized learning suggestions and improvement plans for students. Specifically, it is to use the intelligence and adaptability of artificial intelligence to complete the learning detection, diagnosis, prompt and help, so as to realize the dynamic tracking, collection, analysis and evaluation of students' learning behavior. To construct the index system of classroom teaching evaluation enabled by artificial intelligence technology, we should not only pay attention to the teaching result, but also pay attention to the teaching process; It is not only necessary to ensure the systematic evaluation index, but also to ensure the operability of the evaluation index; Not only the universality of indicators should be considered, but also the individuation of indicators should be considered.

According to the analysis and design of classroom teaching tasks and data presentation mode in general scenarios, the classroom performance of teachers and students based on artificial intelligence technology can be defined. According to the classroom performance of teachers and students, the classroom performance of teachers is divided into three dimensions: classroom involvement, classroom regulation and classroom recognition. The classroom performance of students is divided into three dimensions: students' learning attention, students' learning engagement and students' learning achievement. Multidimensional evaluation indicators can improve the scientificity, fairness and rationality of evaluation. The data acquisition channels are shown in Table 2. Different from the previous evaluation system, the identification and analysis of student evaluation indicators based on artificial intelligence technology make the evaluation more objective and fair.

Table 2 Dimensions and data acquisition of classroom teaching evaluation enabled by artificial intelligence technology

Classroom body	Dimensions	Data acquisition
Teachers	Engagement	Obtained from the teacher's classroom video captured by the camera
	Regulation	Obtained from the teacher's classroom video captured by the camera
	Recognition	It is obtained from the analysis of student evaluation data of the course or teacher, student expression data collected by the camera, and student voice data collected by the recording device
Student	attention	It is obtained by analyzing the data of students' classroom behavior and posture collected by cameras
	Participation	Obtained from the analysis of students' classroom behavior and posture data collected by cameras
	Academic performance	Obtained from a student's exam quiz

3.3 The preliminary construction of the evaluation framework of classroom teaching enabled by artificial intelligence technology

Based on the corresponding tasks, teaching performance and data acquisition methods of teachers and students in classroom teaching supported by artificial intelligence technology, this study can initially construct an AI-enabled classroom teaching evaluation framework, as shown in Figure 1. The framework includes two teaching subjects (namely teachers and students), three teaching links (namely before class, during class and after class), six evaluation dimensions (namely engagement, regulation, recognition, attention, participation and learning performance), and three classroom teaching evaluations (namely classroom language analysis, classroom emotion analysis and classroom behavior analysis). Mainly through the collection of voice, gesture, face and physiological signal data for recognition and analysis, including speech recognition, natural language processing, gesture recognition, expression recognition and EEG based emotion recognition[9].
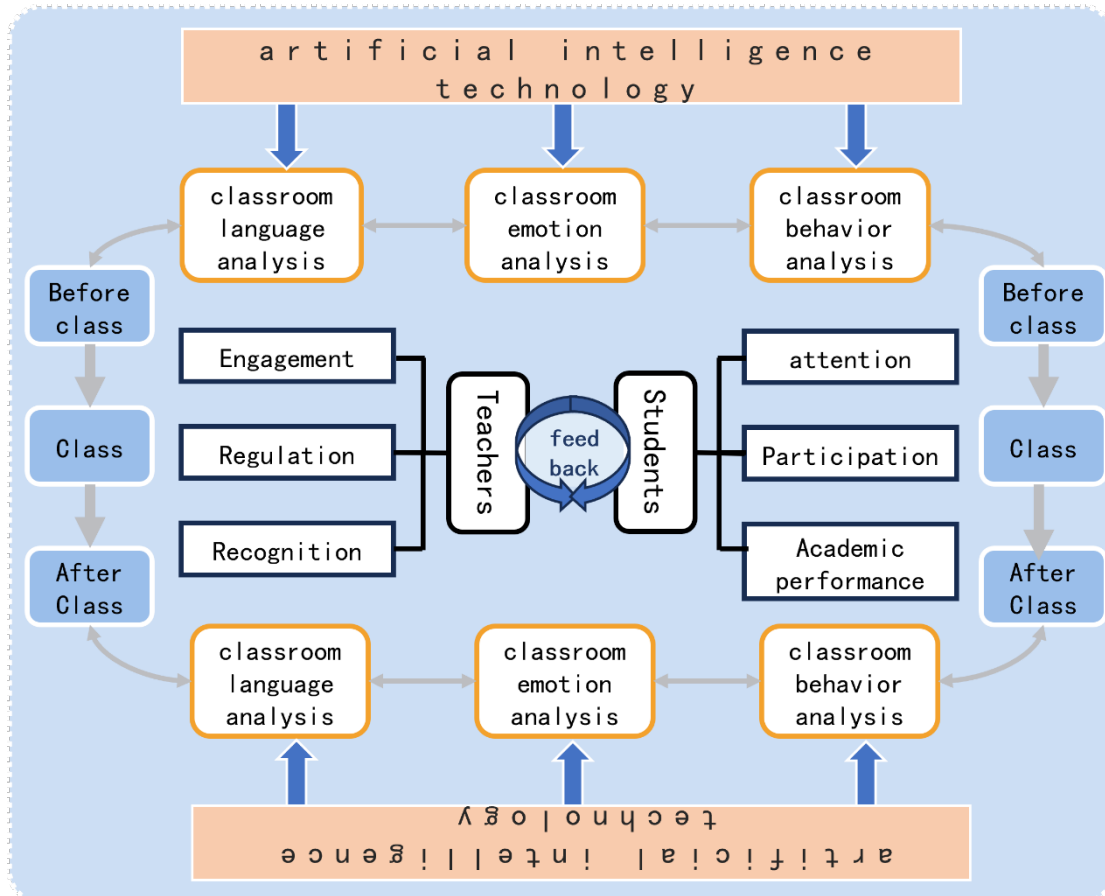
Fig. 1 Classroom teaching evaluation framework enabled by artificial intelligence technology

4. Thoughts and Suggestions

As a powerful driving force to promote the development of classroom teaching evaluation, artificial intelligence technology has innovated the ideas of classroom teaching evaluation, making the content of classroom teaching evaluation more comprehensive, evaluation methods more diverse, evaluation means more intelligent, and evaluation results more efficient. Artificial intelligence enabled classroom teaching evaluation refers to the use of artificial intelligence intelligent perception, multi-source information integration, big data processing, automatic decision-making and other characteristics, accurate analysis of classroom behavior, scientific evaluation results, and give corresponding intervention suggestions, in order to push personalized learning resources and paths, promote positive changes in teaching[10]. Although the current research on AI-enabled education is still advancing rapidly, the research on AI enabled classroom teaching evaluation is still in the exploratory stage. Based on this, this study puts forward the following suggestions:

4.1 Promote the update of artificial intelligence technology and build an evaluation feedback mechanism

In the field of education, artificial intelligence technology has been used to evaluate and explain recessive factors such as teachers' and students' behavioral motivations, emotions, thoughts, and in-depth analysis of explicit factors such as students' knowledge mastery. At present, the application of this technology in the field of education is in the exploratory stage. Although the technology has unique advantages in data collection, calculation, analysis and other aspects, in order to achieve effective evaluation, artificial intelligence technology may need to understand and analyze more complex language use scenarios, lower the threshold for teachers and students to use artificial intelligence, meet the needs of different people, or provide customized services, etc. Therefore, it is necessary to further research and development of artificial intelligence technology, which is also to better play the potential of artificial intelligence technology in classroom teaching evaluation, which is a beneficial attempt and breakthrough to realize the comprehensiveness, comprehensiveness and accuracy of classroom teaching evaluation.

The fundamental purpose of implementing classroom teaching evaluation is to produce effective feedback results, so as to improve teachers' teaching level and realize students' all-round development. However, the process of classroom teaching evaluation enabled by artificial intelligence is not accomplished overnight[11]. In this process, we need to go through a series of cyclic processes such as evaluation, feedback, improvement, secondary evaluation, secondary feedback, and then improvement. Therefore, on the premise of giving full play to the advantages of artificial intelligence technology, we should continue to promote the development and improvement of artificial technology, deepen the diagnostic feedback function of artificial intelligence to classroom teaching, improve the depth and accuracy of evaluation, so that teaching evaluation can be more suitable for the direction of individual needs of people, so as to achieve multiple evaluation means, and even break through the problems of personalized education.

4.2 Explore professional and personalized classroom teaching evaluation indicators to optimize the evaluation process

At present, the research on classroom teaching evaluation supported by artificial intelligence technology is still being explored, but the current development of the theory and practice of AI-enabled classroom teaching evaluation is not synchronized, and the classroom teaching practice always lags behind the theory, and with the increasing attention of the society to the improvement of the overall quality and comprehensive ability of teachers and students, the education goal is gradually multi-dimensional[12]. Therefore, in order to meet the purpose of education to promote people's personality and all-round development, classroom teaching evaluation should pay attention to the in-depth study of personality diversity. For example, different types and subjects have different classroom characteristics, and the proportion of classroom teaching evaluation indicators may be different; The purpose, content and requirements of classroom teaching in different types and disciplines are also different, and their classroom performance may also be different. However, emphasizing the design of personalized evaluation criteria does not mean that the basic indicators are completely separated from the design of personalized evaluation indicators on the basis of the basic indicators to reflect the characteristics of the subject of individuation. At the same time, the professional status of teachers in the design of evaluation indicators should be fully guaranteed when the personalized evaluation standards are constructed. As the professional group with the best understanding of the subject knowledge system, teaching methods and evaluation indicators, teachers can participate in the construction and improvement of evaluation indicators by combining their in-depth understanding of the subject and their own teaching experience, so as to ensure the professionalism of the construction of classroom teaching indicators. Therefore, in the future research, we should fully consider the differences of courses and the professionalism of teachers, explore professional, personalized, diversified and full coverage of classroom teaching evaluation indicators, so as to increase the attention and research depth of teachers' teaching activities and students' learning activities, and make them more targeted to the improvement of classroom teaching practice.

4.3 Clarify the change of teachers' role, create a good education environment, improve own literacy

The data, science and personalization of artificial intelligence technology have brought great convenience to the cause of education, and also reduced part of the teaching pressure of teachers. However, the integration of education and technology has brought impacts and challenges to traditional teaching, and also put forward new requirements for the ability of future teachers. First of all, it poses new challenges to teachers' role. AI-enabled classroom teaching evaluation has changed to take AI and teachers as the evaluation subjects, using AI to assist teachers to complete the evaluation of students' classroom activity, participation, knowledge mastery and other information, and even to match personalized learning tasks for students and push appropriate learning resources. With the assistance of artificial intelligence technology, teachers' teaching tasks are reduced, but in addition to transferring knowledge to students, students' emotional needs in the learning process can not be replaced by virtual teachers, and this has become the aspect that teachers should pay more attention to. Teachers should start to think about how to create a good education environment, so that students can realize the happiness brought by learning, and develop correct values and world views. Therefore, teachers should make clear their role positioning in the era of artificial intelligence, grasp the new changes in teachers' work, put more energy into creative work and create a good education classroom environment, and meet the new challenges of AI-assisted teachers' teaching. Secondly, it has brought challenges to the professional development of teachers. The development of technology will inevitably lead more people to question the professionalism of teachers. Therefore, teachers should constantly improve their own quality, maintain lifelong learning, so that people can play a greater value in the learning of human-computer

interaction. At the same time, teachers should have their own judgment of artificial intelligence technology tools, and be able to clarify the advantages and disadvantages of artificial intelligence evaluation tools, so as to give full play to the characteristics of technology, improve the efficiency and quality of teaching evaluation, and even use this technology to correct their teaching behaviors in time, promote the high-quality development of classroom teaching, and promote their rapid growth.

4.4 Pay attention to privacy protection and data security, while mining the meaning of data

Classroom teaching evaluation with the support of artificial intelligence technology means that the expression, language, movement and other information of teachers and students in the whole process of classroom teaching will be truthfully recorded, which faces the risk of personal privacy infringement. Therefore, when using artificial intelligence technology to perceive, collect and analyze classroom teaching data, it is necessary to carry out under the premise of avoiding risks, and inform teachers and students in advance. At the same time, it is necessary to regulate the rational use and safe storage of data, do a good job of privacy protection, and explore the new changes brought by artificial intelligence for classroom teaching evaluation on the premise of ensuring information security. Of course, while prudently carrying out the evaluation of artificial intelligence classroom teaching, it is necessary to fully tap the advantages of the technology. After the intelligent perception function of artificial intelligence technology is used to collect the process data of teachers and students in the classroom, due to excessive redundant data, there is still a lack of interpretation and analysis of a large number of data to guide teaching more effectively. Therefore, after more in-depth exploration of the use of big data model mining students' historical behavior, performance and other data depth significance, so that it is more intuitive and clear to restore the behavior of teachers and students in the classroom, to carry out more scientific, comprehensive and personalized teaching evaluation, so as to guide the improvement of classroom teaching more targeted, making experiencebased teaching evaluation to scientific and intelligent evaluation development.

5. Conclusion

This framework collects multi-modal classroom teaching activity data, comprehensively uses a variety of identification and analysis techniques, and tries to build a classroom teaching evaluation system. Automatic collection, operation, analysis and evaluation of artificial intelligence technology is the fundamental goal of the application development of classroom teaching evaluation under artificial intelligence. However, most of the current researches are based on the analysis and evaluation of single-modal data, and most of the existing researches stay at the surface, focusing on the category, form and frequency of classroom language, behavior and emotion. And less to explore its deep connotation, the cause of generation and the educational significance and value behind it. The intelligent analysis based on multi-modal data can restore classroom teaching in a more comprehensive and three-dimensional way and carry out classroom teaching evaluation[13]. In the process of classroom teaching, evaluation is the baton, which is the main basis for testing the teaching effect, finding out the problems and shortcomings in teaching, improving teaching methods and improving teaching quality. In the era of artificial intelligence, the focus of student evaluation is no longer the level of knowledge memory and understanding, but focuses on the problem solving ability, communication and cooperation ability, innovation ability and other comprehensive ability level test, the traditional paper-and-pencil evaluation method is obviously no longer applicable, the need for intelligent teaching evaluation is more urgent than ever[14]. The classroom teaching evaluation under artificial intelligence should give full play to its technical advantages of big data collection and processing, and develop professional classroom teaching evaluation indicators with disciplinary characteristics according to the characteristics and development requirements of different disciplines, so as to provide subject-specific implementation plans for the implementation of smart classroom teaching evaluation. In this process, teachers should clarify the change of their own roles, improve their own abilities, give play to their own teaching characteristics, and create a good education environment. Ai-enabled classroom teaching evaluation means that multi-modal data together constitute the organic whole of classroom teaching. In addition to trying to build a classroom teaching evaluation mechanism under multi-modal data, under the premise of ensuring information security, explore the internal correlation between data, and excavate the educational significance and value behind classroom performance. Should be the development path and goal pursuit of the reform of AI-enabled classroom teaching evaluation.

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