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Research on the Exploration of the Future Trends of Online Teaching Evaluation based on the Perspective of the Metaverse

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Abstract: Since the outbreak of the COVID-19 pandemic in early 2020, the education sector has been operating under a special teaching context. Online teaching has become a common practice for dealing with cross-regional, clustered learning, and communication scenarios. Various aspects of online teaching have gradually been improved as online teaching activities continue to unfold. However, the online teaching evaluation process, which assesses the behavior and performance of different participants and aspects in online teaching activities, still has many shortcomings. It is difficult to conduct a comprehensive and objective evaluation of online teaching activities. Metaverse technology, which integrates artificial intelligence, big data, and other technologies, is expected to have a long-term impact on online teaching. Utilizing metaverse technology for online teaching evaluation can overcome the obstacles faced in current online teaching evaluation and promote the achievement of teaching objectives and the development of teaching participants. This article analyzes the problems and causes existing in online teaching evaluation from a metaverse perspective, highlights the advantages of applying metaverse technology to online teaching evaluation, and indicates the intelligent, diverse, and open development trend of future online teaching evaluation. This trend will truly impact every individual involved in the era of high-quality education.

1. Introduction

The COVID-19 outbreak in early 2020 has led to significant changes in the field of education. In response to the call from the Ministry of Education to "suspend classes without suspending learning," primary and secondary schools as well as universities nationwide have carried out large-scale online teaching practices. According to statistics, during the COVID-19 pandemic, a total of 1,454 universities in China conducted online teaching, with 952,000 teachers delivering online courses, 7.13 million online courses available, and 1.18 billion students engaged in online learning. This online teaching practice has been extensive, widespread, and profound in its impact. With the steady control of the epidemic situation, educational activities have gradually returned to normal. However, the traditional offline teaching model, which lacks the involvement of modern information technology, has become a thing of the past. Online teaching has transformed from an emergency measure to a

normalized form of education, and it is reshaping the history of education development in our country. In this process, the rapid development of online teaching has posed new requirements for a corresponding teaching evaluation system. With ongoing research, different online teaching evaluation systems have been established for different educational stages, including online academic performance evaluation and online teaching quality evaluation. However, in the face of the trend towards the normalization of online teaching, many issues in the current online teaching evaluation system need to be addressed in order to better adapt to the future development of education and respond to the changes in online teaching.

2. The Manifestations and Impacts of the Normalization of Online Teaching

With the normalization of online teaching, the online teaching evaluation system has been rapidly established, and evaluation platforms associated with online teaching have been developed in practice, playing a crucial role in assessing teaching effectiveness. Moreover, the rapid development of online teaching has led to the emergence of blended learning models that combine online and offline instruction, presenting new requirements for online teaching evaluation. These requirements primarily include the following two aspects.

2.1. Online Teaching has become an Important Form of Normalized Instruction

With the rapid popularization of computers and the Internet, the avenues for acquiring and disseminating knowledge have undergone significant changes, driving transformations in the field of education. Online education, with its convenience and efficiency, has quickly become an effective supplement to traditional teaching methods for university teachers and students. In early 2020, the COVID-19 pandemic erupted, and the Ministry of Education released the "Guiding Opinions on Organizing and Managing Online Teaching in Higher Education Institutions during the Epidemic Prevention and Control Period." This document highlighted the trend of developing online teaching activities during this unique period. Consequently, numerous online teaching platforms emerged to assist teachers and students in completing teaching tasks collaboratively online.

These platforms include online meeting programs such as Tencent Meeting and Alibaba DingTalk, where teachers and students engage in learning, as well as online video classrooms enriched with teaching resources like Rain Classroom and MOOCs [1]. Diverse platforms have been established through live streaming or synchronous classroom formats, connecting teachers and students to accomplish teaching tasks. Correspondingly, to facilitate the smooth implementation of online teaching, frontline teachers and researchers have proposed online teaching models tailored to different subjects and learning environments. Under the context of "Internet+," models such as MOOCs and OBE have been employed to digitize the teaching process, ensuring the controllability and operability of online instruction.

The abundance of online teaching platforms and the maturity of online teaching models have laid a solid foundation for the normalization of online teaching and have also imposed new requirements on the evaluation of online teaching achievements. The demand for evaluating the effectiveness of online teaching on different platforms and the practical challenges of connecting data between various platforms urge further research on online teaching evaluation for better application. Moreover, as mature online teaching models face the trend of blended learning that combines online and offline instruction, it becomes essential to ensure compatibility and effectiveness with traditional teaching models through more comprehensive online teaching evaluation.

2.2. Requirements of Online Teaching Normalization for Online Teaching Evaluation

As an important form of instruction, online teaching will continue to develop and further leverage its advantages in transcending time and space based on the current blend of online and offline teaching. It will integrate and expand teaching resources, enhance teacher-student interaction, and become a significant role in education. Especially with the gradual maturity of technologies such as artificial intelligence and the metaverse, the trend of intelligent development across various industries is becoming increasingly clear. In this context, education and instruction will inevitably be influenced by modern technologies [2]. The introduction of new technologies and new thinking through the process of online teaching will provide new choices for responding to emergencies and improving teaching quality.

In such a developmental trend, online teaching evaluation, which examines and assesses various aspects of the teaching process, will play a more important role. Therefore, it is crucial to explore the technical means that can adapt to the new teaching environment for online teaching evaluation, identify the authentic participants in the evaluation process, determine the convenient and effective evaluation criteria, and utilize the results of online teaching evaluation as the basis for assessment and verification. These are important issues that need to be further discussed. This process needs to progress continuously along with the development of online teaching, requiring a transformation in evaluation techniques and evaluation thinking. Evaluation orientation, criteria, methods, and mechanisms should serve the rapidly evolving form of online teaching, enhancing the scientific level and credibility of online teaching evaluation [3]. Attention should be given to the generalization of the final evaluation results, enabling online teaching evaluation to truly play a role in regulation and guidance, and facilitating the effective implementation of online teaching.

3. Shortcomings and Causes of Current Online Teaching Evaluation

3.1. Shortcomings of Current Online Teaching Evaluation

Firstly, there are technical difficulties in conducting online teaching evaluation. Although only a terminal device is needed for simple teaching activities in a networked environment, to achieve better teaching outcomes, more sophisticated online teaching software, comprehensive hardware infrastructure, and smooth network environment are required. For example, both teachers and students need advanced terminal devices such as smartphones or computers capable of online teaching, as well as high-speed wireless networks. If learning is done on a mobile phone, considerations must be given to the speed of the mobile network and communication quality to ensure that both teachers and students can connect to the internet at high speeds and communicate effectively [4]. Therefore, during online teaching evaluation, there are often situations where a comprehensive and authentic evaluation cannot be made due to insufficient hardware equipment or network fluctuations. Teachers find it challenging to intuitively understand the learning environment in which students are situated and the physical and mental states of students during evaluation. The delayed responses of students to the verbal and nonverbal cues from teachers can introduce errors, affecting the scientific and authentic assessment of students' learning. It becomes difficult to clearly measure the extent to which students have mastered the content. Similarly, it is challenging to comprehensively evaluate the teaching effectiveness of teachers under the constraints of limited devices and technologies. In the process of evaluating teaching quality, not only should the focus be on teaching outcomes, but also on the teachers' relevant competencies in using information technology during online teaching. It is necessary to assess whether teachers are proficient in operating different platforms for teaching, whether they can identify and address students' technical issues encountered during the learning process, and whether they can pay attention to as many

students as possible during online teaching.

Secondly, there are resource barriers in conducting online teaching evaluation. Another issue in online teaching evaluation is the use of online teaching resources. During online teaching, teachers and students need to use common or similar teaching resources, such as textbooks, videos, teaching aids, etc. However, due to practical constraints, teachers and students are in different teaching environments during online teaching. In particular, recording online video courses puts teachers and students in different time frames, making it difficult to match the teaching resources available to students with those used by teachers [5]. As a result, it becomes challenging to make value judgments according to uniform standards during online teaching evaluation. It is necessary to consider the impact of different teaching resources on teachers' and students' teaching activities, and the significant differences in teaching resources due to different temporal and spatial environments. Under such conditions, the subjects of online teaching evaluation, the standards adopted, and the utilization of evaluation results are all issues that require urgent discussion. For example, how to correlate the teaching resources mastered by students with their learning outcomes and measure them according to certain weights, in order to appropriately recognize students' efforts and achievements, thereby enhancing students' motivation for online learning. Alternatively, matching the teaching resources of teachers and students during online teaching and paying attention to the differences in resources can compensate for unexpected teaching effects caused by resource disparities during evaluation, thus overcoming the unscientific and subjective nature of teaching evaluation resulting from the differentiation of teaching resources.

Furthermore, there is an issue of teacher-student interaction in conducting online teaching evaluation. During online teaching, video images and voice are the main means of communication between teachers and students. Even if teaching is conducted through instant messaging systems, when the classroom is reduced to the size of a computer screen, the student's image on the computer still cannot provide much visual cues for the teacher. The teacher can only sense the presence of students when they see them moving or blinking. This is different from offline teaching, where the teacher and students are physically present together, sensing each other's presence through a sense of connection. Moreover, teachers' attention is mostly focused on the content of the lecture, and the electronic image of the students is hidden, making the students completely disappear. In the teacher's mind, there is only an imaginary class. Teachers can only confirm students' attention by continuously asking questions, and the teaching is primarily based on auditory cues [6]. When teachers cannot sense the presence of students for a long time, their motivation decreases as the sensory cues weaken. The asynchrony of online teaching time prevents teachers from constantly monitoring every student, and students, due to the boring nature of the course, may enter a time-accelerated space, such as playing video games to pass the time. The phenomenon of time stopping also allows students to answer teachers' questions again at the appropriate time and hide their mistakes. As a result, the teacher-student relationship becomes complex and uncontrollable. In conducting online teaching evaluation, both teachers and students find it difficult to make objective, genuine, and credible assessments. For example, while teachers have a rough plan for the overall progress of the class, it is challenging to grasp the learning progress of each student participating in the classroom teaching. Even if a unified online teaching evaluation is conducted, it lacks the opportunity to explain and apply the evaluation results to each student due to the lack of physical interaction and real-time contact with students during the teaching process. This leads to a discrepancy between the evaluation results and reality, making them difficult to use.

Lastly, ensuring teaching quality is challenging in conducting online teaching evaluation. Students are direct participants in online learning, and if their self-directed learning and self-guidance abilities are not promptly improved, they will struggle to adapt to the weak supervision of online learning, ultimately leading to the problem of "being online but not learning." As the primary objective of

online teaching evaluation is to assess and ensure teaching quality, it should not only focus on students but also on teachers and the classroom environment. Both teachers' online capabilities and students' online learning abilities have many deficiencies. The transition from "offline teaching" to "online teaching" requires more than just mastering the use of technological tools; it also necessitates the development of diverse skills in teachers and students. The purpose of conducting online teaching evaluation is to guide teachers and students in addressing their own issues in a timely manner and successfully completing teaching tasks. This requires effective evaluation methods, standardized evaluation criteria, and comprehensive technical support from online teaching platforms. Timely feedback should be provided to teachers and students regarding their performance in teaching activities, promoting interaction between them and encouraging the efficient completion of teaching tasks. Additionally, online teaching evaluation should also focus on various elements involved in the teaching process, including the alignment of teaching objectives, teaching content, and the use of teaching resources, as well as the level of engagement of teachers and students in teaching activities, and the utilization and handling of online teaching evaluation results. Therefore, the current online teaching evaluation does not have a broad focus on ensuring the quality of online teaching compared to the assurance of offline teaching quality, and further improvements are still needed.

3.2. Causes of Insufficiency in Current Online Teaching Evaluation

The first cause is the establishment of a unified online teaching evaluation platform. Currently, in schools or platforms, online education mainly utilizes third-party online conferencing software or live streaming software such as DingTalk Live, Tencent Classroom, Tencent Meeting, and others. Some schools or teachers also use short video platforms with live streaming functionality, such as WeChat, Douyin (TikTok), Kuaishou, and so on. These different online live streaming software platforms usually require users to register using their own mobile phone numbers, and their functionality is designed to cater to market competition, resulting in varying user experiences [7]. They are not specifically designed for online teaching purposes. Therefore, when schools or teachers choose an online teaching platform, they need to compare the similarities and differences in functionality among different products and consider the learning costs, allowing each teacher and student to become proficient in using different live streaming software. This way, when a software platform encounters problems, teachers and students can promptly switch to another platform to ensure the normal continuation of teaching activities. On the other hand, these live streaming software platforms are not developed specifically for online education, and using them for online teaching is only a small part of their application functionality [8]. As a result, software platforms do not invest too many resources in targeted development for online education. Conversely, short video platforms and live streaming platforms primarily seek user traffic for other main functionalities, and teachers and students become a part of this user base. This misalignment clearly deviates from the goal of using live streaming for online teaching. What has a greater impact on online teaching is that when students use platforms like Douyin or Kuaishou for online learning, they are often easily attracted by the short video content on the platform, resulting in a lack of focus on the teaching activities. Therefore, it is crucial to build a unified online teaching platform for conducting online teaching evaluation.

Next is the development of teachers' online teaching evaluation capabilities. In the process of online teaching, teachers are still the mainstay of instruction, making it particularly important to enhance their application skills in information technology. Compared to traditional teaching, online teaching has not only undergone changes in form but also in concepts and content. This requires teachers to have self-innovation abilities and an innovative mindset to adapt to new teaching activities. Teachers need to continuously learn new technologies, participate in online teaching-related learning, training, or competitions, and integrate information technology related to online teaching into their

daily lives and work. By doing so, they can continuously improve their level of network technology and handle issues in online teaching activities more adeptly. At the same time, educational administrators should focus on the development of the teaching staff, cultivate teachers' innovative mindset, develop classroom evaluation mechanisms suitable for online teaching, and better motivate teachers to innovate with different technologies and teaching models. This will help more frontline teachers establish awareness of online teaching, enrich teaching content, innovate teaching methods, and gradually make online teaching a convenient and effective instructional activity. Additionally, attention should be given to relieving teachers' psychological stress. Schools should provide better support for teachers in terms of psychological counseling and stress reduction, enabling teachers to have more confidence and motivation to engage in online teaching activities.

Lastly, it is essential to establish a supervision team for online teaching evaluation. The assistance provided by teaching supervision is crucial for a scientifically valid assessment of teaching quality. Teaching supervision involves the oversight and guidance of teachers. In offline teaching, schools typically assign experienced and outstanding teachers with teaching expertise to observe classroom instruction, evaluate teaching quality, and gain firsthand experience of various activities in the classroom [9]. They assess the teacher's teaching attitude and language, allowing for an objective evaluation of teaching quality. However, evaluating online teaching quality poses new requirements for teaching supervision, and the current evaluation system still needs further improvement. Additionally, teaching supervision also focuses on students' attention and support. During online teaching, the abundance and entertainment value of online resources can easily distract students' attention. While students may develop self-learning abilities by utilizing internet search engines, the vast amount of information available tends to make them rely on finding answers online, making it difficult for them to exercise independent thinking and lacking in knowledge structure and summarization skills. This can lead to two extremes: students who hold high expectations for themselves may benefit from the assistance of the internet, resulting in improved academic performance, while students with weaker willpower and lower self-expectations may experience a significant decline in their grades. Therefore, schools and teachers need to supervise students' learning habits, help them change their learning perspectives, and strengthen their willpower in order to facilitate better knowledge acquisition.

4. The Development Opportunities for Online Teaching Evaluation

The process of online teaching evaluation will become increasingly intelligent, diverse, and open with the development of new technologies in the future. Such changes are intertwined with the development of online teaching itself. The future trends in online teaching encompass multiple directions, and one of the new opportunities lies in the maturation and implementation of the educational metaverse. The metaverse refers to a virtual space that is distinct from the real world, characterized by real-time online interaction, integration of the virtual and physical realms, immersive experiences, collaborative creation, and shared management [10]. These characteristics align with the development trends of online teaching. Currently, metaverse-related technologies have been applied in educational practices, demonstrating significant potential in various teaching scenarios, such as personalized learning, gamified learning, special education, and teacher professional development. These applications facilitate the further transformation of online teaching towards intelligence [11].

Firstly, the educational metaverse promotes the intelligence of online teaching evaluation by utilizing big data in a virtual environment. It collects and analyzes behavioral records, biometric signals, and other parameters generated during the teaching process to assess the effectiveness of student learning and teacher instruction. It dynamically monitors teachers' teaching processes as well as students' academic performance, classroom behavior, and emotional attitudes. This allows for a

comprehensive evaluation of the behaviors of both teachers and students involved in teaching activities, while also supervising teachers' instructional activities and promptly identifying issues [12]. The intelligence of online teaching facilitates overcoming the difficulties encountered in data collection, inconsistent monitoring standards, and insufficient problem identification during online teaching evaluation. It focuses on the behavioral performances of every individual involved in the metaverse-based teaching activities [13]. By presenting complete process data observed by authorized evaluators, timely access to the performance of teaching subjects is achieved. This enables a comprehensive analysis and objective evaluation, truly achieving data-driven, integrated, and transparent online teaching evaluation aimed at promoting high-quality teaching. It constructs a future online teaching evaluation system that drives high-quality teaching. Moreover, metaverse technology incorporates a variety of intelligent technologies throughout the entire process of teaching activities, enhancing the interactivity between teachers and students in online teaching. It includes interactions between teaching subjects and virtual teaching content through the use of virtual teaching tools and engagement with virtual environments, promoting the orderly operation of teaching activities and achieving true human-computer collaboration. Educational metaverse transforms the traditional relationship between individuals, groups, and technology in interactive settings, generating interactive forms of engagement among multiple subjects such as teachers, students, and technology in teaching activities. It establishes an intelligent application field with bidirectional feedback between humans and machines, supporting cross-boundary collaboration and innovation among multiple subjects. Through the integration of in-school learning and social learning, classroom learning and after-class learning, offline learning and online learning, the metaverse allows for experiences that cannot be achieved in real life within the virtual space, opening up new realms of learning, breaking through spatial and temporal limitations, and expanding the boundaries of online teaching. Online teaching evaluation also extends its focus beyond classroom activities to include informal learning activities, catering to students' personalized learning needs and addressing their psychological requirements during learning activities. Through immersive participation, students develop a sense of identity and engagement with the virtual environment and teaching activities through interactions with teachers, fostering active involvement in the learning experience.

Furthermore, educational metaverse enables the diversification of the subjects involved in online teaching evaluation. The diversity of participants in the educational metaverse determines the diversity of subjects involved in online teaching evaluation. Teachers, students, parents, schools, governments, developers, and third-party organizations, among other relevant entities in the virtual teaching environment, become the main subjects of online education evaluation. The involvement of diverse subjects allows for comprehensive evaluations from multiple perspectives, effectively ensuring the accuracy and comprehensiveness of online teaching evaluation. In traditional offline teaching activities, students lack autonomy in conducting teaching evaluations, and their academic performance is primarily assessed through "external evaluations." This leads to a complete oversight of students' learning needs and emotional experiences during online teaching evaluations. However, as active participants in online teaching activities, students have a comprehensive understanding of teachers' performances and their own interactions with other students throughout the entire process. Therefore, they should be fully involved in online teaching evaluation. Moreover, the educational metaverse further promotes the diversification of evaluation standards and processes. Students' external learning behaviors and internal psychological dynamics, influenced by the Internet and the Internet of Things, are continuously recorded and transformed into data, providing comprehensive and multidimensional data for online teaching evaluation. This enables the transition from a singular evaluation standard based on knowledge mastery, such as grades and scores, to a multifaceted approach that focuses on the development of thinking skills, exploratory abilities, self-learning capabilities, problem-solving skills, and other competencies. The value orientation of evaluation

shifts from the singular development of students' learning abilities to a holistic development, paying greater attention to students' individual growth and dynamic progress. In the educational metaverse, online teaching evaluation methods also become more diverse. In addition to outcome-based evaluations that focus on individual data, the evaluation methods include process-based evaluations that consider the entire process of teaching activities, performance-based evaluations that examine behavioral data of teachers and students during teaching activities, and value-added evaluations that analyze changes in data before and after teaching activities. These various evaluation methods are comprehensively applied. The future development trend of online teaching evaluation will closely follow the changes of the metaverse era, emphasizing the collection, organization, and analysis of data in online teaching, enhancing the level of evaluation diversification, and promoting the high-quality development of online teaching evaluation.

Additionally, the environment of educational metaverse makes online teaching more open, allowing for the resolution of obstacles such as lack of teaching interaction and mismatched teaching resources due to different environments for teachers and students during online teaching evaluation. The educational metaverse fundamentally changes the isolated state of teaching resources by intelligently connecting vast teaching resources with the teaching environment or individual entities with teaching resource demands. In traditional offline teaching and current online teaching, the main teaching resources used are paper-based resources, multimedia resources, and online resources. Teachers need to act as intermediaries between students and teaching resources in order to match the resources students need with the existing resources. In the educational metaverse, teaching resources primarily involve the digitized restoration and interactive editing of real scenes and objects related to teaching activities. Students can directly relate to and deeply perceive the teaching resources during the interactive process. Teaching resources in the metaverse can be shared, and with the advantages of openness and inclusivity, teachers and students who use teaching resources also become creators of teaching resources. Schools, developers, and other entities involved in developing teaching resources can involve teachers and students in the process of editing and creating teaching resources. By continuously updating and enriching teaching resources based on suggestions from participants involved in teaching activities, diverse needs of online teaching activities can be met. Using technologies such as blockchain and digital twins, the educational metaverse integrates teaching resources from different sources and with different attributes into an open digital resource repository. It collects, organizes, and categorizes physical entities from reality, edits them into virtual digital twin images, and facilitates the search for resource data by participants engaged in virtual teaching activities. Throughout this process, the teaching resource repository is continuously updated, and various platforms showcase, circulate, and share resources through network interconnections. Students can achieve cross-platform and cross-regional interaction with teaching resources in the metaverse. Leveraging artificial intelligence technology, educational metaverse expands and explores teaching resources, develops intelligent teaching content, ensures sustainable production of teaching resources, and dynamically allocates resources and provides personalized resource recommendations to each student based on their individual needs [14]. Furthermore, the educational metaverse breaks down the barriers of accessing educational resources in the physical world, optimizes the allocation of teaching resources, and facilitates the circulation of teaching resources. It helps students with varying difficulties and qualities in accessing teaching resources, regardless of their geographical location, social class, or age, to equally enjoy high-quality teaching resources. It redistributes teaching resources, provides equal opportunities for access to teaching resources to underdeveloped regions and disadvantaged groups, and offers solutions to the constraints faced in the dissemination of educational resources, such as limitations of time and space, uneven development, and utilization difficulties. It increases opportunities for students in different regions receiving online teaching to have equal access to online teaching evaluation.

Lastly, due to the open interaction, intelligent connectivity, and diverse inclusiveness of the educational metaverse environment, it becomes possible to establish a unified online teaching platform and adopt unified online teaching evaluation. Through the joint efforts of the government and schools, within the educational metaverse environment, teaching entities and teaching resources located in different time and space can communicate with each other, access resources in a timely manner, and involve more third-party evaluation entities in virtual identities in online teaching activities to deeply understand and monitor the performances of different individuals in this process, thereby making online teaching evaluation traceable and verifiable. This process takes place on a unified platform, effectively eliminating the influence of different teaching resources and teaching environments, truly achieving fairness and comprehensiveness in online teaching evaluation. Furthermore, online teaching evaluation results generated through the unified platform will have higher credibility. They serve as certification for the participants in teaching activities and can be recognized and utilized in different scenarios, carrying the same weight as teaching evaluations conducted in offline teaching activities. This will enhance the credibility of online teaching evaluation, aid the development of online teaching activities themselves, encourage more teachers and students to engage in online teaching activities, thereby improving the quality of online teaching activities, developing richer online teaching resources, promoting knowledge sharing, and cultivating more talent.

5. Conclusion

In the era of increasingly normalized online teaching, the development of online teaching evaluation has become a pressing issue that requires attention. The emergence of the educational metaverse provides new opportunities for online teaching and evaluation. Faced with this innovative online teaching environment, we need to break through the traditional mindset of offline teaching evaluation. While retaining the basic theories and principles of conducting teaching evaluation, we should maximize the advantages of the educational metaverse. This will help teachers and students gain a deep understanding of their own dynamics and accomplishments during the process of engaging in teaching activities, make timely corrections for areas that need improvement, and truly impact every individual involved in the upcoming era of intelligent, diverse, and open high-quality education.

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