RESEARCH ARTICLE

Application and Exploration of Cloud Classroom Realtime Interactive System in Teaching

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Abstract

Information technology is changing with each passing day. Cloud services are the Internet resource service with the development of networked information technology in recent years, and has been successfully applied to teaching in universities, as one means of interaction and communication between teachers and students. Firstly, the current application status of cloud services in teaching was analyzed in this paper. Secondly, a detailed analysis was conducted on the composition, component modules, and functional characteristics of a real-time interactive system for cloud classroom. A case study of the course question bank and student management module were analyzed in detail. Finally, the application prospects and development directions of information technology in the education industry were summarized, providing reference for the construction and development research of educational informatization.

Keywords: cloud services, information technology, university teaching, classroom interaction.

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1 Introduction

In today's world, information technology represented by computer and network technology is developing rapidly, and various information technologies and new concepts are changing with each passing day, such as the Internet of Things, big data, cloud services, Internet+, 5G+, artificial intelligence (AI), etc. The direction of the fourth industrial revolution collects to massive amounts of data and store it on cloud platforms, and provide better services for human life and production through big data analysis, AI, etc. [1, 2]. Cloud services refer to internet-based computing resources that can be accessed remotely. Cloud services are usually virtualized, dynamically scalable resources. Therefore, any behavior of using a network to perform calculations on multiple computers, or to obtain services provided by remote hosts through the network, belongs to cloud services. Therefore, cloud services generally refer to obtaining the required services through the network in an on-demand and easily scalable manner. The development of information technology not only promotes social and economic progress, but also promotes innovation in educational technology and teaching methods.

When cloud services are combined with teaching, the so-called 'cloud teaching' has emerged. Cloud teaching refers to the integration of digital teaching content by using mobile devices, such as computers,

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tablets, mobile phones, etc., and Internet technology. In the cloud teaching environment, each student can use mobile devices to conduct learning activities such as listening, questions and answers (Q&A), classroom interaction, etc. through the wireless network connection system [3, 4].

The outbreak of the COVID-19 at the end of 2019 has impacted many industries, but some fields and scientific and technological industries such as health care, remote office, online education have gained development opportunities, and played an important supporting role in social production, daily office work, life learning, etc. During the COVID-19 epidemic [5, 6], cloud computing, as a fundamental computing resource, plays a crucial role in these fields. Especially in response to the policy of "suspending classes without stopping learning" in primary, secondary, and tertiary schools, cloud teaching has obvious advantages. By absorbing high-quality online course teaching resources, coordinating and integrating relevant teaching resources, we provide a rich and diverse range of high-quality online course teaching resources that cover various regions, fully ensuring the online "teaching and learning" of teachers and students in schools around the world. Therefore, cloud teaching has become both an emergency response to the epidemic situation and an application demonstration of Internet+ education [7].

In this paper, the current application status of cloud services in teaching was analyzed. And then, a detailed analysis was conducted on the composition, component modules, and functional characteristics of the real-time interactive system for cloud classroom. A case study of the course question bank and student management module were analyzed in detail. Finally, the application prospects and development directions of information technology in the education industry were summarized, providing reference for the construction and development research of educational informatization.

2 Current Status of Cloud Classroom Applications and Research

The specific combination of cloud services and teaching varies slightly depending on different application scenarios and focus areas. Nowadays, cloud services are mainly applied in micro classroom design, teaching platform design, real-time feedback and interaction in classroom teaching, and self-directed learning in the classroom. The characteristics of micro course learning and researched the design of cloud based interactive micro courses on mobile devices was studied in [8], which presented the abstract framework components and a cloud-based software architecture that allowed a modular approach to creating such mobile applications. The application of micro courses on cloud teaching platforms was mainly focused in [9], in which deeply explored the practical application and significance of micro courses on the basis of cloud teaching platforms, promoting the widespread application and development of micro courses. The foreign language cloud course was taken as an example to prove the integration of cloud (education) services in general can increase the efficiency of the learning process in [10]. The impacts and issues of teaching Apps on bilingual teaching was analyzed in [11], also, the application of Chaoxing teaching Apps in the bilingual lecture of International Accounting as a case study, in order to presenting the effective practice of teaching Apps in bilingual accounting courses. The addition of intelligent algorithms to wireless network communications was studied in [12], to optimize and build autonomous mobile learning for cloud education, and proposed how to reduce the energy loss in wireless communication and find the best intelligent algorithm to realize the cloud education mobile learning platform.

After the outbreak of the epidemic, in order to actively respond to the policy of "suspending classes without stopping learning", online classroom and cloud teaching has become mainstream and inevitable choices for a period of time. A batch of new teaching methods and achievements have been further promoted and applied. With the support of the popular WeChat, the problem-based learning (PBL) method was adopted to guide teaching activities around problems in [13], and it achieved better teacher-student emotional interaction, improved learning outcomes, and enhanced the effectiveness of online teaching. The present study in [14] described how we managed the crisis by adapting a conventional flipped course to a fully online flipped course, using the community of inquiry conceptual framework, which provided practical guidelines for instructors who are interested in the online flipped classroom approach. The policy implications and how the policy may be further improved in practice were discussed in [15], and suggested that the government needs to further promote the construction of the educational information superhighway, consider equipping teachers and students with standardized

home-based teaching/learning equipment, conduct online teacher training, etc. The study in [16] conducted a bibliometric review to map the challenges during the COVID-19 pandemic and suggested strategies for higher education institution (HEI) to cope with post-pandemic situations in the future, which had implications for policymakers and HEI management to rethink the delivery of future courses with a focus on education and institute sustainability. The convenience provided by information technology in the teaching process through the use of a cloud classroom real-time interactive system has been fully utilized to improve student participation in the classroom in [17], in which the Internet of Things and smart classroom provide great convenience for future smart campus construction, daily teaching, and campus management and can also provide reference for the construction of smart classrooms in other universities.

Based on the current research status, cloud classroom has been widely applied and explored at teaching different disciplines and majors. From classroom teaching to platform design and development, from practical application exploration to relevant theoretical learning, the application and development of real-time interactive cloud classroom systems have great prospects.

3 Real time interactive system for cloud classroom

Traditional classroom, especially those with centralized teaching, have less interaction and communication between teachers and students. Classroom questions often go unanswered and the atmosphere is dull. Therefore, real-time interactive systems have emerged in the classroom. Classroom interactive system is a real-time interactive feedback system based on cloud technology, which can connect to the cloud anytime and anywhere through mobile tools (such as mobile phones, tablets, computers, etc.), and easily access classroom teaching information. This system can activate classroom teaching, enhance classroom teaching interaction, and is welcomed by a large number of teachers and students.

The cloud classroom interactive system generally includes multiple basic functions such as course question bank, feedback discussion, course related, student management module, and open Q&A, as shown in Figure 1. The open Q&A function module allows students to answer questions online in the classroom through mobile devices or other clients, and real-time statistics and display of answer results, such as the number of people, proportion, and current accuracy rate selected for each option. It can also be set to answer anonymously or with real names. The course question bank can arrange the PPT classroom content for each class, such as teaching courseware, classroom quizzes, homework assignments, mid-term reports, and final feedback. Taking the course question bank module as an example, the teaching teacher can send pre-set questions through the cloud at any time during the class, and ask students in the classroom and online classes to answer questions online through portable devices such as mobile phones or tablets, and can display real-time data such as the number of respondents and accuracy rate. This kind of interaction greatly improves students' attention and attitude during class. By setting up anonymous answers, multiple-choice questions, and other methods, course statistics data can be obtained in a timely and time-saving manner, which is more convenient and convenient than offline data collection through class groups. The advantages of cloud based compared to traditional class group statistics methods are summarized as shown in Table 1.

Table 1. The advantages of cloud based compared to traditional methods.

Category	Traditional Class Group Statistics	Cloud based
Efficiency	Manual collection time (5-10 minutes/question)	Automatic statistics (<1 second)
Accuracy	Easy to miss or make mistakes	System automatically verifies and ensures 100% accuracy
Participation	Some students do not respond to	Anonymous mode to reduce stress, resulting in a 30% increase in participation rate
Data analysis	Need to manually organize Excel real-time	Visualization and automatic generation of historical reports
Scene adaptation	Only offline	Support for blended learning (online+offline)

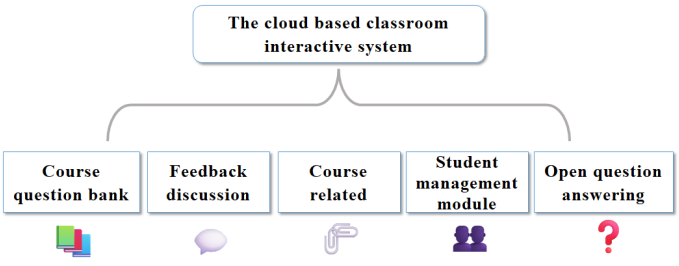

Figure 1. Basic functions of the cloud classroom interactive system.

Student management module mainly includes functions such as student list, group list, roll call and sign in, and statistical data, as shown in Figure 2. The system supports multi criteria filtering based on

student ID, name, and class, and can be associated with student grades, attendance, and reward and punishment records. Grouping can achieve dynamic grouping, such as automatic allocation of groups based on grades/interests, or free grouping, where students can choose their own groups and teachers approve them. After grouping, the task progress of each group can be displayed in real-time. The student roll call function is currently a widely used feature, which allows for the free setting of roll call numbers and displays attendance fluctuations by week/month, thereby calculating the correlation between absenteeism rates and final grades.

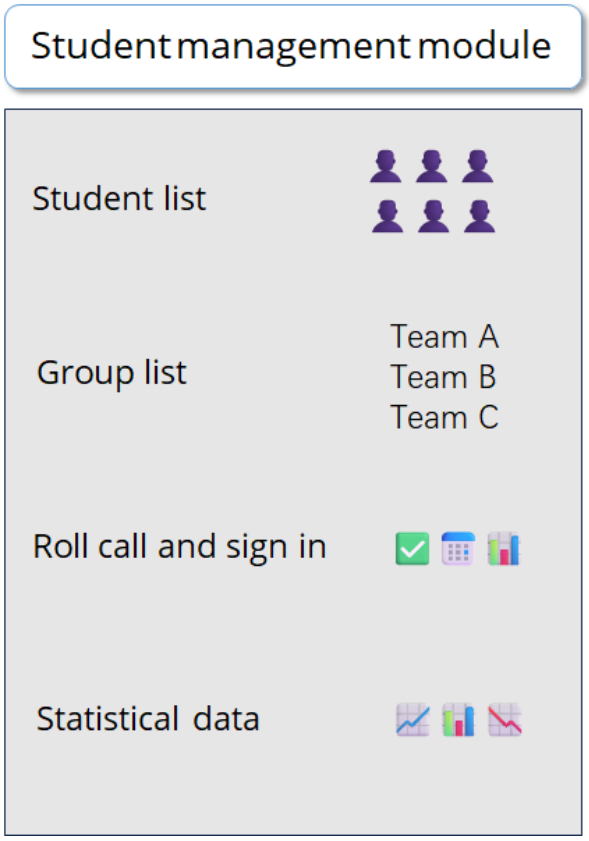

Figure 2. Basic functions of student management module.

The cloud classroom interaction system can provide teachers with convenient and effective classroom interaction modes, and assist in establishing diversified courses. Through personal mobile devices, teachers and students can conveniently engage in real-time Q&A, efficient interaction, and communication in the classroom. It also can check students' answer status and answer accuracy at any time, and conduct statistical analysis of the results by realization of class electronic test paper examination, in order to timely grasp students' learning status. Student classroom participation and collaborative learning have been increased, through student grouping, group discussions and responses, real-time peer evaluations, etc., which can improve learning efficiency.

The core value of cloud classroom lies in digitizing classroom interaction and driving teaching innovation through real-time data. In the future, AI and Augmented Reality (AR) can be combined to further upgrade the experience. For example, using AI to intelligently recommend wrong questions to different students, and providing immersive answering scenarios through AR.

4 Discussion

Cloud-based teaching demonstrates broad applicability in modern education, particularly in higher education and vocational training. This approach enables flexible adaptation to various teaching scenarios, including emergency remote teaching during public health crises and resource-limited educational environments. While cloud education effectively bridges geographical and resource gaps, its implementation faces challenges related to technological infrastructure and digital literacy among both educators and learners, requiring careful consideration of local conditions and capacity building.

Empirical evidence suggests cloud-based instruction significantly enhances learning outcomes through improved accessibility and interactive capabilities. The integration of cloud platforms facilitates personalized learning experiences and supports diverse pedagogical approaches, from flipped classrooms to collaborative project-based learning. However, effectiveness varies across disciplines, with practice-oriented subjects often requiring supplementary technologies like virtual simulations to achieve optimal results, highlighting the need for discipline-specific adaptations in cloud teaching models.

Successful implementation of cloud-based education requires attention to several critical factors. Institutions must provide comprehensive training for educators in cloud platform utilization and digital pedagogy. Course designers should focus on developing high-quality, pedagogically sound digital resources while maintaining manageable cognitive loads. The shift to cloud environments also necessitates robust data security measures and careful platform selection to protect sensitive educational data and ensure reliable service delivery.

Potential challenges in cloud-based teaching include widening digital inequalities and increased cognitive

demands on participants. Disparities in technology access may exclude disadvantaged learners, while the transition to digital learning environments can create additional workload pressures for educators and potential fatigue for students navigating multiple platforms. Furthermore, maintaining meaningful interpersonal connections and collaborative learning experiences requires intentional design in virtual settings, as spontaneous interactions characteristic of physical classrooms may diminish in cloud environments.

Future development of cloud-based education should focus on three key areas: infrastructure enhancement, pedagogical innovation, and policy support. Investments in reliable cloud infrastructure and digital literacy programs will form the foundation for scalable implementation. Emerging technologies like AI-assisted learning analytics and adaptive learning systems present opportunities to enhance personalization and efficiency in cloud education. At the policy level, establishing standards for cloud-based education quality and promoting equitable access will be crucial for realizing the full potential of cloud-based teaching while mitigating potential drawbacks. These strategic directions will enable cloud education to evolve as a sustainable, effective component of modern education systems.

5 Conclusion

The rapid advancement of information technology has fundamentally transformed educational paradigms, serving as a powerful catalyst for innovation in both educational technology and pedagogical methodologies. Cloud computing services, as one of the most significant technological breakthroughs in recent years, have revolutionized traditional classroom dynamics by enabling seamless virtual learning environments and facilitating real-time, interactive teaching experiences. These cloud-based platforms not only enhance the informatization level of education but also significantly improve teaching effectiveness through features like collaborative document editing, instant feedback mechanisms, and multimedia resource sharing. Both educators and learners benefit substantially from these technological innovations, as they promote comprehensive classroom teaching reform while optimizing the quality and efficiency of interactive instruction.

However, the landscape of educational technology continues to evolve at an unprecedented pace, with emerging innovations like mobile Internet, big data analytics, artificial intelligence (AI), Internet+, and the Internet of Things (IoT) constantly reshaping the boundaries of what's possible in education. These cutting-edge technologies are undergoing continuous refinement and iteration, each bringing unique capabilities that promise to further revolutionize teaching and learning processes. Looking ahead, information technology will undoubtedly play an increasingly vital role in education, leveraging its distinctive advantages to create more personalized, adaptive, and effective learning experiences. The integration of these technologies will enable more sophisticated applications such as intelligent tutoring systems, learning analytics, and predictive modeling of student performance.

The transformative power of information technology extends far beyond classroom instruction, profoundly impacting three critical dimensions of modern education: talent cultivation, discipline construction, and social services. Advanced technological tools facilitate the development of customized learning pathways that nurture students' individual potential, while data-driven approaches support the systematic enhancement of academic disciplines. Furthermore, technology-mediated education bridges the gap between academic institutions and societal needs, enabling more responsive and relevant knowledge dissemination.

As we stand on the threshold of a new era dominated by cloud-based big data, the pace of educational innovation is accelerating exponentially. This data-rich environment will empower educators with unprecedented insights into learning patterns, enabling real-time curriculum optimization and predictive intervention strategies. The convergence of cloud computing with other emerging technologies promises to create intelligent educational ecosystems that are more inclusive, efficient, and responsive to the evolving needs of 21st-century learners. In this context, educational institutions must proactively adapt to harness the full potential of these technological advancements while addressing associated challenges such as digital equity, data privacy, and the need for continuous professional development of educators.

Data Availability Statement

Data will be made available on request.

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Conflicts of Interest

The authors declare no conflicts of interest.

Ethical Approval and Consent to Participate

Not applicable.

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