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Application and Exploration of Cloud Technology in University Classroom Teaching - Take Cloud Classroom as an Example

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Abstract: **With the continuous evolution of information technology, cloud technology has gradually become a focal issue in the field of education. This article focuses on the practical application and in-depth exploration of cloud technology in classroom teaching, aiming to reveal how cloud classroom can revolutionize traditional education models and improve teaching quality. The article first explains the basic concepts and core characteristics of cloud technology and cloud classroom, and then analyzes their unique advantages in classroom teaching. Subsequently, it deeply explores the limitations faced by cloud classroom in classroom teaching applications and corresponding solutions. Through detailed literature review and case analysis, it is found that cloud classroom has great potential in creating flexible learning environments, promoting cooperative learning, and realizing personalized learning. This study provides valuable insights and references for educators and decision makers in the application and exploration of cloud classroom in classroom teaching, further promoting the process of educational modernization.**

Keywords: **cloud technology, cloud classroom, cooperative learning, personalized learning.**

I. INTRODUCTION

With the continuous development and popularization of AI technology, the combination of cloud technology and education will become an inevitable trend, and cloud classrooms under cloud technology will gradually become a hot topic in the field of education. Educators actively explore and apply cloud classrooms to improve and enhance the quality and effectiveness of classroom teaching. The application of cloud classrooms in education has shown enormous potential, promoting innovation in education and providing more flexible and personalized learning and teaching environments for students and teachers (Liu Jing&Cui Lei, 2021).

Cloud classroom is not only a technological means, but also a manifestation of educational and teaching concepts. Through cloud classrooms, students can access and manage learning resources anytime, anywhere, for self-directed and collaborative learning. Teachers can use cloud classrooms to conduct online teaching, assist students in learning, and evaluate their learning outcomes. Cloud classrooms can break the time and space limitations of traditional classrooms, providing students with broader learning space and richer learning resources.

This paper will study the application and exploration of cloud classroom in classroom teaching under cloud technology, and explore how to fully utilize cloud computing technology to improve and enhance the effectiveness of classroom teaching. The advantages of cloud classroom application in teaching, as well as the limitations and solutions of cloud classroom application in classroom teaching, have become the focus of this paper. Through the research in this paper, it will help educators and decision-makers to deepen their understanding of the application and exploration of cloud classrooms in classroom teaching, providing valuable reference and inspiration for educational reform and innovation. At the same time, it can also inspire education practitioners to rethink teaching models and methods, and actively promote the transformation and development of education.

II. OVERVIEW OF CLOUD TECHNOLOGY

The Concept of Cloud Technology

Cloud computing is an internet-based computing model that provides computing resources and services, including hardware, software, and storage resources, through a network. Cloud computing centrally manages resources such as computing power, storage, and data processing, and provides them to users in the form of services. Users can access and use these resources and services anytime, anywhere through the Internet.

Cloud technology is based on virtualization technology and the concept of distributed computing, which disperses computing and storage resources in multiple locations, and achieves resource sharing and effective utilization through flexible configuration and automated management. Cloud computing dynamically allocates and scales resources based on user needs, providing a flexible and scalable computing environment (Zhou Yuhao&Wang Yushan, 2021).

Cloud technology includes three main service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). In IaaS mode, users can rent infrastructure resources such as servers, network devices, and storage space to build their own application environment. In PaaS mode, users can use the development tools and runtime environment provided by the cloud platform to quickly develop and deploy applications. In SaaS mode, users can directly use application software provided by cloud service providers without paying attention to the underlying technical implementation and maintenance (Zhang Ruijun&Lin Caiyan et al., 2018).

Cloud technology has the following characteristics:

- Flexibility and scalability, allowing users to adjust the usage of resources according to their actual needs at any time;
- High availability and reliability, cloud technology distributes resources across multiple locations to ensure service continuity and data security;
- Economy and cost savings: Users can pay on demand according to their needs, avoiding resource waste.

Cloud technology has been widely applied in various fields of individuals and enterprises, including education, healthcare, finance, entertainment, etc., providing users with convenient, efficient, and reliable computing and storage services.

The Application of Cloud Technology in Classroom - Cloud Classroom

Cloud classroom is an educational model based on cloud technology, providing online teaching and learning services through cloud computing platforms and the Internet. Cloud classroom transfers the traditional physical classroom environment to a virtual online teaching platform, where students and teachers can participate in teaching activities anytime and anywhere through the Internet.

The core of cloud classroom is to achieve the sharing of teaching resources and the online teaching process through cloud technology. In cloud classrooms, teachers can upload and share teaching materials, including courseware, textbooks, homework, etc., through the cloud platform. Students can access and download these teaching resources through cloud platforms for learning and homework completion. At the same time, cloud classrooms also provide various interactive and collaborative tools, such as online discussions, real-time Q&A, homework submission, etc., to promote interaction and cooperation between students and teachers (Liu Zhen&Zhang Min&Zhou Feng, 2021).

The advantage of cloud classrooms is that they provide a more flexible and personalized learning environment. Students can access and learn teaching resources anytime and anywhere according to their own pace and learning needs. Teachers can flexibly adjust teaching content and methods based on student feedback and learning situations, achieving personalized teaching. Cloud Classroom also provides data analysis and learning evaluation functions, which can monitor and provide personalized learning guidance for students.

Cloud classrooms can not only expand the coverage of educational resources, overcome geographical and time constraints, but also promote the sharing and exchange of global educational resources. Students and teachers can participate in international collaborative projects through cloud classrooms, exchanging learning experiences and cultures with educational institutions and students worldwide. Cloud classrooms can also support distance education and online degree programs, making learning more popular and convenient (Yan Tianming, 2018).

In summary, cloud classrooms bring new opportunities and challenges to education through the application of cloud technology, providing students with a flexible and personalized learning environment, and innovative and efficient teaching methods for teachers. The development of cloud classrooms will undoubtedly drive changes and progress in the field of education.

III. FEASIBILITY ANALYSIS OF CLOUD CLASSROOM APPLICATION IN CLASSROOM TEACHING

The application of cloud classroom to classroom teaching has significant feasibility. It breaks through the limitations of time and space, provides rich teaching resources, and enhances the interaction between teachers and students. As long as it is properly planned and implemented, cloud classroom can effectively improve teaching quality and efficiency.

Analysis of the Current Situation of Traditional Classroom Teaching

Traditional classroom teaching has always been the mainstream educational model, but there are also some problems and challenges in the current educational environment. The following is an analysis of the current situation of traditional classroom teaching:

1. Information asymmetry: In traditional classroom teaching, information is mainly transmitted from teachers to students, and the role of students is relatively passive. Teachers need to impart a large amount of knowledge within a limited time, and student participation and autonomy may be low, which may limit learning effectiveness.

2. Limited educational resources: Traditional classroom teaching is constrained by the geographical location and material conditions of teachers and students, facing limited resources such as classroom space, textbooks, and teaching equipment. This limitation may affect the richness and diversity of teaching content, limiting the breadth and depth of knowledge and learning resources that students are exposed to.

3. Individual differences among students: Traditional classroom teaching emphasizes group teaching and large-scale teaching, with limited response to individual differences and special needs of students. Some students may need more personalized learning support and guidance, which traditional classrooms find difficult to meet.

4. Lack of interaction and participation: The interactive ways of traditional classroom teaching are relatively limited, and students often only passively accept knowledge and lack active participation. Teachers usually face large classes, and it is difficult to have in-depth communication and interaction with each student, which may affect students' learning motivation and enthusiasm.

5. The evaluation method is relatively single: In traditional classroom teaching, evaluation often focuses on written tests, emphasizing students' memory and application ability of knowledge. This evaluation method may not fully and truthfully reflect the learning situation and abilities of students. At the same time, timely feedback and personalized evaluation for students also face certain difficulties.

Overall, traditional classroom teaching has problems such as information asymmetry, limited resources, individual student differences in response, insufficient interaction and participation, and relatively single evaluation methods. Therefore, the education sector is constantly exploring and applying new educational models and technologies, such as cloud classrooms and online teaching, in order to provide more flexible, personalized, and efficient teaching methods.

The Advantages of Cloud Classroom Application in Classroom Teaching

The application of cloud classroom in classroom teaching can transform students' learning methods, teachers' teaching methods, teaching evaluation, the utilization of teaching resources, and teaching management, thus stimulating students' enthusiasm for learning and improving teaching quality.

1. Transforming Student Learning Methods

Cloud classroom can fully mobilize students' learning initiative. In class, the most important part is the interactive feedback. The communication and feedback between students and teachers can be fed back to teachers through cloud classroom, and teachers can strengthen the interaction with students in class and after class according to the feedback, which in turn enhances the interaction between students and teachers. Students no longer sit in the classroom and listen to the teacher, but can listen to the lecture anytime in any place with the Internet, which greatly improves the flexibility of the classroom.

Cloud classroom is used to improve students' autonomous learning ability and improve students' learning effect. In the course of teaching, teachers sometimes involve many aspects of knowledge, teachers need to spend a lot of time and energy to explain, students are not easy to understand, and students' learning effect is not good. In the analysis of cloud classroom design, from the perspective of "everything for students", teachers can integrate teaching content into the teaching platform through text introduction of various knowledge points, picture display and other ways to make students interested in learning. In classroom teaching, unique and novel information presentation can attract students' attention. Stimulate their interest in learning.Students selectively start learning from the knowledge points they are interested in, guide them to gradually deepen their learning through the internal connections between knowledge points, and transform scattered knowledge points into knowledge system learning. This reduces the difficulty of learning for students and improves their learning effectiveness (Wei Pingping&Lu Xi, 2020).

2. Transforming Teacher Teaching Methods

The role of teachers has undergone a significant change. Originally, teachers were mainly responsible for imparting knowledge, but now they are organizing and arranging the entire teaching process, collecting teaching materials, arranging Q&A content, interacting and communicating with students through cloud platforms, and collaborating with students to complete some projects. Making students truly the protagonists is beneficial for teachers to provide personalized teaching to each student. The application of cloud classroom in classroom teaching will have higher requirements for teachers. Firstly, teachers need to collect the latest and most cutting-edge teaching materials; Secondly, teachers must be familiar with using cloud platform related teaching aids and improve teaching skills. Cloud classrooms place higher demands on teachers' professional skills, requiring them to have deeper communication with other students, teachers, or those who learn online through cloud platforms, share teaching resources with each other, promote the development of cloud classrooms, and jointly improve the quality of class content and the effectiveness of learning together (Lu Xiaotao&Qiu Yuan et al., 2019).

The application of cloud classroom in classroom teaching facilitates teachers to understand the learning situation of students and adjust teaching reasonably. Cloud Classroom connects student terminals with teacher terminals, achieving information exchange and sharing through cloud classrooms. Teachers do not need to walk back and forth in the classroom or ask students one by one, so they can grasp the learning situation of each student. Based on the common situations that students encounter, they can timely discover and adjust the focus and difficulties of teaching, and provide targeted guidance and teaching. The commonly used teaching methods in teaching are combined with the use of cloud classrooms. Teachers divide tasks into several small tasks based on teaching objectives. Students can upload their completed works to the teacher's terminal at different times. By viewing student works, teachers can understand the completion status of student tasks, grasp the learning progress of students, and then organize the next teaching plan and content. At the same time, teachers can also showcase excellent works through the cloud, motivate students, improve their learning initiative, cultivate their sense of achievement, which is also conducive to the organization and implementation of teaching by teachers.

3. Transforming Teaching Evaluation

The traditional forms of learning evaluation mainly include oral evaluation, written assignments, and post class assessments. Students receive homework and then complete it. The teacher corrects the homework and explains the wrong questions, while the students correct the homework. The time interval between each step is too large, which can affect the efficiency of the teacher's knowledge transmission.

When cloud classroom is applied to classroom teaching, teachers can use electronic files instead of written homework, conduct in-class tests, and then timely feedback on the answers, but also immediately know the concentrated errors of students, so that not only can timely understand the knowledge of students and improve the timeliness of teachers' teaching, but also know the answers of each student. This is more targeted. Homework that is too late to finish in class can be used as homework after class; Or if students have questions and want to review, both teachers and students can log in to the cloud classroom teaching platform, select the teaching materials they need to view, watch the teaching content, communicate with classmates, and comment on the teacher's class. Similarly, teachers and other teachers can log in to the cloud classroom platform to evaluate students and teachers. This kind of evaluation subject is more abundant, more convenient, and the evaluation content is more comprehensive and persuasive. Through analyzing the content of evaluation and students' learning situation and learning behavior, cloud classroom can obtain comprehensive evaluation on students' learning situation, put forward more scientific and favorable suggestions and opinions for students' future learning, and provide

references for teachers' improvement of teaching methods. Students can also conduct self-evaluation and reflection through the evaluation of others, have a more comprehensive understanding of their learning status, and make adjustments and changes in thinking and behavior.

4. Transforming the Utilization of Teaching Resources

Because cloud class has low client requirements and cloud services are relatively cheap, and some services are free, the necessary cloud services can be obtained from basic facilities only at a low cost in teaching, which saves the university a lot of laboratory construction and maintenance costs. In classroom teaching, teachers and students use computers connected to the network and access the cloud platform through relevant software to complete the required teaching tasks, which greatly saves the capital investment in the construction of smart classrooms. Because the teaching of cloud classroom has relatively low requirements on computer hardware, there is no need to replace computer equipment with higher configuration, saving the cost of computer hardware purchase and upgrade.

With the continuous development of the Internet, all parts of the country have increased the construction of Internet education in order to meet the needs of the development of the times and change the way of education and scientific research, which has increased the demand for universities to purchase software and hardware facilities. With the continuous development of educational technology and information technology, the teaching environment required by teachers in the teaching process has also undergone changes. The application of cloud classroom has effectively alleviated the demand for the cost of software and hardware updates in universities. It provides services using Internet technology, and universities can obtain new teaching resources without software and hardware updates. Users who access the Internet can get corresponding services by simply operating, which meets the needs of school teaching. This provides abundant resource services and a high-quality environment for university teaching and research, effectively solving the problem of insufficient teaching resources. Schools are more likely to implement online teaching, and more universities are joining the queue of online classrooms (Yang Jin, 2018).

5. Transforming Teaching Management

Cloud classroom is applied to classroom teaching. It can know the learning situation of any student at any time and anywhere, and it can give a student individual tutoring, which is conducive to improving the overall learning effect of students, tracking the learning process of students, and facilitating the management of students' learning outcomes. If it is found that students are not good at learning, teachers can point out their shortcomings through the cloud platform, follow up the students' grasp of knowledge points in real time, and clearly understand the weaknesses of students. Teachers can better understand the key and difficult points in teaching, which is conducive to the development of teaching (Mou Ping, 2017).

IV. LIMITATIONS AND SOLUTIONS OF CLOUD CLASSROOM APPLICATION IN CLASSROOM TEACHING

There are many restrictive factors in the application of cloud classroom in classroom teaching, such as unqualified infrastructure and network conditions, data security and privacy issues, insufficient teacher training and technical support, etc. Corresponding measures should be taken to solve them so that classroom teaching can be carried out smoothly.

Factors Restricting the Application of Cloud Classroom in Classroom Teaching

Cloud classroom is based on the Internet environment and runs in the big data environment of cloud technology. Therefore, the application of cloud classroom in classroom teaching also faces some constraints, including the following aspects:

1. Infrastructure and network conditions: Cloud classrooms require good network and infrastructure support in order to achieve efficient online teaching. However, the network conditions in some regions or universities may not be good enough, limiting the application and effectiveness of cloud classrooms. Problems such as network delays, instability, and bandwidth limitations can lead to delays and interruptions in the teaching process.

2. Data security and privacy issues: The application of cloud classroom involves a large number of student and teacher data storage and transmission, and data security and privacy protection has become a key issue. The protection of sensitive data such as students' and teachers' personal information and academic performance requires reliable security mechanisms and measures to prevent data leakage or abuse.

3. Teacher training and technical support: The application of cloud classroom requires teachers to have the corresponding technical ability and knowledge of using cloud platform. However, some teachers may not know enough about cloud classrooms and lack relevant training and support, making it difficult to give full play to the advantages of cloud classrooms in teaching. Therefore, strengthening teacher training and technical support is an important part of promoting cloud classroom application.

4. Students' acceptance: The application of cloud classroom requires students' active cooperation. Under the Internet big data environment, cloud classroom learning is borderless. Borderless learning is both an advantage and a disadvantage of cloud classrooms. Some universities in Shenzhen and Shanghai have already started using iPad for teaching. On the one hand, this can facilitate students to use new media for learning, which is also more lightweight compared to books. On the other hand, this is also a test of students' self-discipline ability. Laptops, iPad, and other electronic devices have many functions, and whether students can use them for learning is a question worth exploring.

Limitations and Solutions of Infrastructure

Infrastructure constraints are an important limitation in applying cloud classrooms to classroom instruction.

1. **Unstable network conditions**: The network conditions in some areas may not be stable enough, which may lead to problems such as network disconnection or delay when using cloud classrooms, thus affecting the smooth progress of teaching. To address this issue, universities and governments can invest more in network equipment, improve campus network stability, and ensure that teachers and students can access and use cloud classrooms smoothly. At the same time, a backup network can be set up to seamlessly switch over if there is a problem with the main network, ensuring that teaching is not affected.

2. **Insufficient computing devices**: Some universities may lack powerful computing devices, which limits the application of cloud classrooms. Universities can increase the procurement quantity of computing devices to ensure that each classroom is equipped with sufficient computing devices to support teachers and students in using cloud classrooms for teaching. Meanwhile, by using virtualization technology, multiple terminals can share the same powerful server, which can save the number of computing devices and improve device utilization.

3. **Power supply issue**: Some regions may have unstable power supply, which may cause cloud classrooms to malfunction. Universities can install UPS (uninterruptible power supply) or generators as backup devices to cope with temporary power outages and ensure the stable operation of cloud classrooms. It is also possible to reduce reliance on power supply by properly managing and planning the energy consumption of equipment, such as selecting low-power equipment and adjusting the operating mode of equipment reasonably.

4. By implementing the above solutions, universities can overcome infrastructure limitations, provide a stable network environment and powerful computing device support, and create favorable conditions for the application of cloud classrooms in classroom teaching. This can improve teaching effectiveness and provide students with a more convenient and efficient learning experience.

Limitations and Solutions of Information Management

Data security and privacy concerns are an important consideration when applying cloud classroom to classroom instruction.

1. **Data storage and transmission security**: Educational institutions can use secure protocols such as SSL/TLS to encrypt data transmission and ensure the safety of data during transmission. At the same time, universities should regularly backup data to prevent data loss or damage, and provide data recovery mechanisms for teachers and students to ensure data security and stability (Jiang Jianjun & Ding Zhifeng, 2016).

2. **User authentication and access control**: The University should require faculty and students to have strong passwords and change them regularly to prevent unauthorized access. The introduction of two-factor authentication requires users to provide additional authentication information, such as a mobile phone verification code or fingerprint identification, to increase account security. In addition, ACL can be used to restrict access to sensitive data or resources, ensuring that only authorized users can access relevant content.

3. **Data privacy protection**: The University can use data encryption technology to encrypt sensitive data during storage and transmission to ensure the security and privacy of data on the cloud platform. Universities should develop clear privacy

policies and require explicit informed consent from faculty and students to ensure they understand how their data is collected, used and protected.

4. **Security audit and monitoring**: The University can establish a log recording and real-time monitoring system of security events to discover and respond to potential security threats or data breaches in a timely manner. Educational institutions should regularly scan and repair security vulnerabilities to ensure the security of cloud platforms and applications.

5. **Compliance and legal requirements**: The University shall understand and comply with relevant data protection laws and regulations, ensure that the data of teachers and students is legally processed and protected, and sign data processing agreements and contracts with cloud service providers to clarify the responsibilities and obligations of both parties for data security and privacy protection.

By adopting the above solutions, universities can address data security and privacy issues in the application of cloud classrooms in classroom teaching, ensuring that the data of teachers and students is securely processed and protected. This can increase confidence in using cloud classrooms and encourage them to play a greater role in teaching.

Limitations and Solutions of Technical Training

The lack of cloud classroom knowledge and training support for teachers can be addressed by:

1. **Provide special cloud classroom training**: Universities can organize cloud classroom training courses for teachers to train teachers how to use the cloud platform for classroom teaching, teaching resource management and technical support operations and applications. These training courses can include basic cloud classroom knowledge, the capabilities and use of cloud platforms, as well as teaching cases and best practices.

2. **Provide personalized support and guidance**: The university can set up a dedicated technical support team or instructor to provide personalized cloud classroom support and guidance for teachers. These support teams or instructors can provide one-on-one or group training and guidance according to the specific needs and problems of teachers, and solve the confusion and problems of teachers in the process of cloud classroom application.

3. **Resource sharing and community building**: Universities and school districts can establish cloud classroom resource sharing platforms or online communities, so that teachers can share and discuss the application experience and best practices of cloud classrooms with each other, learn from and support each other. Such a platform or community can provide resources such as teaching cases, teaching resources, training materials and technical support to help teachers better understand and use the cloud classroom.

4. **Introduction of professional third-party services**: The university may consider introducing professional third-party service providers, who have rich experience and professional knowledge to provide professional training and technical support for teachers. These service providers can tailor training to the needs of universities, provide technical advice and solutions to help teachers take full advantage of the cloud classroom.

Through the above measures, teachers can overcome the difficulties in cloud classroom application, improve their technical ability and knowledge of using cloud platform, so as to better apply cloud classroom in teaching and improve teaching effect. At the same time, universities can also establish a long-term and stable mechanism to constantly update and improve cloud classroom training and support measures to adapt to the rapid development of education technology.

The Limitation and Solution of Students' Acceptance Degree

Using cloud classroom to teach knowledge greatly facilitates teachers and students, breaks the limitation of time and space, and diversifies the way of teaching and learning. However, when teachers teach through the cloud and students listen to lectures on the Internet, it is difficult for students to express their problems, and students cannot communicate with teachers face to face. As a result, students may not be able to acquire knowledge from the cloud classroom well and have some deficiencies.The simple application of cloud classroom in classroom teaching is not enough, but also combined with the actual classroom, teachers can arrange time for classroom question-and-answer, and have real interaction with teachers. If some teaching content cannot be displayed in the cloud classroom, teachers can also teach through the actual classroom. Real education is not a single, should be diversified, teachers should organically combine the traditional teaching methods and cloud classroom, should timely choose different teaching methods, more helpful to students is the best (Chai Huifang & Yang Yuhui et al.,2022).

V. CONCLUSION

Cloud technology has brought tremendous opportunities for transformation in the field of education, and as one of its important applications, cloud classrooms have broad development prospects. Through flexible learning environments, effective collaborative learning, and personalized learning strategies, cloud classrooms are changing traditional teaching modes, making education more modern and intelligent. However, the application of cloud classrooms also faces some challenges, such as technical issues and learning effectiveness evaluation. To address these issues, we need to conduct further in-depth research and explore effective solutions. At the same time, it is also necessary to strengthen the training of teachers, improve their technical level and teaching ability, so that they can better apply cloud classrooms to carry out teaching activities. In the future, with the continuous development of cloud computing technology and the deepening of educational informatization, we believe that cloud classrooms will play a greater role in the field of education. We look forward to more educators actively participating in the research and application of cloud classrooms, and jointly promoting the modernization process of education (Wu Rongjin, 2022).

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