



# Research on the Application of Cloud-Computing-Based Smart Teaching Environment in Foreign Language Teaching<sup>1</sup>

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Date of Submission: 01-08-2025

Date of Acceptance: 11-08-2025

**Abstract:** Cloud computing technology is one of the most popular network applications currently, while the smart teaching environment represents a new teaching philosophy and an inherent requirement for the development of educational informatization. At present, many universities face issues such as high construction costs, redundant construction, difficulties in resource sharing, and subpar teaching application performance in their online course teaching environments. This study, based on the concepts of smart teaching environment and the SPOCs (Small Private Online Courses), designs a smart teaching environment grounded in SPOCs and explores its application in foreign language teaching and learning in higher education.

**Keywords:** Smart teaching environment; Cloud computing; SPOC; Foreign language teaching and learning

## I. Introduction

Any learning activity takes place within a specific learning environment, which encompasses all supportive conditions that facilitate the development of learners. As a new educational and teaching philosophy, the smart teaching environment impacts the construction of teaching resources and influences both teachers' teaching methods and students' learning approaches. The advancement of information technology drives educational reform, providing favorable conditions for educational informatization and resource sharing. Cloud computing technology introduces new perspectives for the informatization of education, facilitating the creation of an informatized teaching environment. Learning activities within the context of informatized education are characterized by smart learning under cloud computing conditions. It needs to adopt novel learning models that integrate traditional with modern, virtual with real, as well as online with recorded teaching modes (Huang, et al., 2012).

Wikipedia defines cloud computing as the provision of IT-related capabilities as services to users, allowing them to access the required services via the Internet without needing to understand the underlying technology, possess relevant knowledge, or have equipment operation skills. The precursor to cloud computing was grid computing in the late 1980s (which utilized parallel computing to solve large-scale problems) and utility computing in the late 1990s (which provided computing resources as metered services). Its emergence heralded the advent of an era of low-cost supercomputing. After 2009, cloud computing entered the educational sector. According to the 2009 Horizon Report jointly published by the New Media Consortium and the EDUCAUSE Learning Initiative, cloud computing was predicted to become a mainstream technology in schools within the next 1-2 years, influencing both teachers' teaching methods and students' learning approaches. The application of cloud computing in education and teaching has introduced the new concept of "Cloud Computing Assisted Instruction" (CCAI).

CCAI refers to the use of services provided by "computing" by schools and teachers to construct an informatized environment for personalized teaching, supporting both teaching and learning, and enhancing teaching quality. As an emerging field of disciplinary research, CCAI represents a new development in informatized education (educational technology). It falls within the intersection of computer science and educational science, focusing on the application patterns of services provided by cloud computing in education and teaching within an informatized environment. It emphasizes "soft technology" rather than the hardware technology of cloud computing, with its core being the informatized instructional design supported by cloud computing services. "Cloud Computing Based Education" (CCBE), on the other hand, refers to "education based on cloud computing," where the concept of "education" is broader than that of "teaching." This means that

<sup>1</sup> This paper represents partial achievements of the 2024 Quality Engineering and Teaching Reform Project at Zhaoqing University, funded by the Academic Affairs Department of Zhaoqing University (project No. zlgc2024077).



services provided by “cloud computing” can be fully utilized to assist educational activities across various domains of education.

## **II. Analysis of Problems in Online Course Teaching Platforms**

As an emerging field of disciplinary research, the construction, application, and corresponding instructional design of CCAI face numerous problems. These problems primarily manifest in aspects such as the online development of courses, the influence of traditional course teaching models, and limited information resource scales. Regarding online teaching platforms for foreign language instruction, there is relatively little research on language laboratories currently. Issues in laboratory construction include complex hardware and software, poor stability, cumbersome usage, limited types, and insufficient smartness in teaching and control. Therefore, how to expedite the construction of smart language laboratories and fully leverage their role in promoting teaching is a research question that universities need to address (Zhou, et al., 2024).

### **2.1 Problems in Online Course Development**

In the development of open courses, corresponding online course teaching platforms need to be constructed. Due to various influencing factors, numerous problems exist in the online development of courses. For instance, the overall design in course construction may be overlooked, failing to design the online representation of the course through its content. Teaching resources and their presentation formats lack diversity and flexibility. Insufficient attention is paid to updating teaching content, preventing online teaching resources from fully playing their role in teaching. Emphasis is placed only on surface design, neglecting the construction of course content and giving little consideration to fostering learners’ deep thinking. Many courses are hosted on the university’s “intranet”, making them difficult to access from the “external network,” resulting in insufficient course openness and resource sharing (Guo & Guo, 2014). With the development of informatization in higher education, the number of various teaching platforms continues to increase, and different departments within universities are also engaging in informatization management construction. Almost every business requires its own server, leading to increasing investments in manpower, material resources, and finances, as well as rising network operation and maintenance costs and management complexity for universities. In recent years, influenced by the Massive Open Online Courses (MOOCs) concept, many universities have been

following the trend to construct their own MOOCs, further increasing the burden on educational informatization in universities.

### **2.2 Adherence to Traditional Teaching Models in Courses**

The learning process in traditional teaching typically consists of two phases: knowledge transmission and knowledge internalization, namely, teacher lectures and demonstrations in class and student reviews and assignments after class. With fixed courses, teachers, and students organized by class, predetermined indirect knowledge is imparted. Teachers are the main subjects of teaching activities, while students are in passive receptive positions, lacking communication and interaction between teachers and students. Students’ learning resources are limited to “teachers + textbooks.” Currently, many online course teaching platforms are designed following traditional teaching models, featuring obvious “one-way” and “passive” characteristics, and lacking interaction mechanisms between teachers and students. Students cannot promptly resolve issues during the learning process through the platform, nor can teachers promptly understand students’ learning conditions. There is a lack of real-time recording of student attendance and class participation, failing to truly reflect students’ learning states. Real-time measurement is lacking, preventing timely adjustments to teaching methods and progress. Real-time evaluation is insufficient, failing to accurately reflect students’ understanding of knowledge and problem-solving abilities. Teaching resources on the platform are scarce, with a single presentation format and slow update speed. The platform struggles to achieve continuous learning through heterogeneous access terminals (such as mobile phones and laptops).

### **2.3 Limited Scale of Information Resources Storage**

Information resources on online teaching platforms mainly include course teaching materials (such as course content, videos, and exercise resources), interactive materials, and student works. As the time and scale of course construction continue to expand, the pressure on required storage space also increases, directly affecting the normal use of the platform. Currently, due to the lack of unified construction standards for the online teaching platforms of various courses, universities have to invest significant manpower and material resources in platform design and production, particularly in addressing the storage issues of various course resources.



### **III. Construction and Application of Smart Learning Environments**

According to the perspective of curriculum and teaching theory, the concept of a classroom encompasses three levels: first, the traditional sense of a physical classroom; second, classroom teaching activities within the school; and third, the integration of curriculum and teaching activities. These three levels represent a progressive relationship, with the classroom serving as a physical environment that supports the implementation of the curriculum. For an informatized classroom environment in education, it should be a new type of classroom that optimizes the presentation of teaching content, facilitates access to learning resources, promotes classroom interaction, and possesses contextual awareness and environmental management functions. It is a product of the organic integration of multimedia technology and networked classrooms, which we refer to as “smart classrooms” (Chen, 2015).

With the rapid development and widespread application of emerging technologies such as cloud computing, the Internet of Things, and big data, the learning environment in universities is evolving from digitization to smartness, gradually developing into a smart learning environment. Regarding the concept of a smart learning environment, different scholars have proposed definitions from their respective perspectives. Malaysian scholar Chin proposed that a smart learning environment is a new learning environment based on information technology and centered around learners, providing support for their lifelong learning and all-round development (Zheng, et al., 2017). Huang et al (2025) suggested that a smart learning environment can optimize the presentation of teaching content, facilitate access to learning resources, promote classroom interaction, possess contextual awareness and environmental management functions, identify learner characteristics, automatically record classroom teaching processes, and evaluate learning outcomes. Based on the above understandings of smart learning environments, the author believes that a smart learning environment is one that relies more heavily on technology and better supports learners’ autonomous and personalized learning requirements. Smart learning environments can be classified into smart classrooms, smart libraries, smart laboratories, smart training rooms, etc., based on physical space environments. This article specifically refers to smart teaching environments as smart classrooms. A smart teaching environment is an intelligent teaching venue that supports high-level interactions among multiple dimensions, including people, technology, resources, and the environment. It generally consists of several parts, such as application

modules, teaching resources (including network resources, cloud resources, and campus resources), cloud service management, server cluster groups and interaction management, infrastructure, and learning terminals (including PCs, laptops, smartphones, electronic schoolbags, etc.). In a smart teaching environment, the relationship between teachers and students is one of equality and interaction (Chen, 2015). The cloud-computing-based smart teaching environment not only possesses the basic functions of a cloud service system, alleviating the investment pressure on universities’ informatization construction but also ensures the smartness of the Small Private Online Courses (SPOCs’) small-scale online environment.

#### **3.1 Construction of Smart Teaching and Learning Environments in Universities**

Firstly, an open-source cloud platform is utilized to construct the infrastructure of a private cloud SPOCs environment. In the virtual environment, a single sign-on server is configured to provide “one-stop services,” facilitating the sharing of teaching resources. Simultaneously, it reduces unnecessary frequent logins, alleviates users’ burden of remembering multiple usernames and passwords, simplifies the user experience, and enhances user satisfaction.

Secondly, a cloud computing platform based on Hadoop Distributed File System (HDFS) is deployed in the virtual machine cluster to enhance platform scalability, effectively integrate fragmented resources, extend the lifespan of old equipment, and significantly improve equipment utilization. It centrally manages various resources, broadens channels for resource sharing, and utilizes private cloud service scheduling and network management technologies to improve the overall load capacity of the system, enabling better performance of the equipment.

Thirdly, stable and reliable resource management is achieved through the private cloud’s node management, storage management, and fault-tolerance technologies.

Fourthly, leveraging cloud computing and middleware technologies, a highly compatible course platform that supports multiple types of terminals, including desktops, laptops, tablets, smartphones, and cloud computing virtual terminals, is created. Simultaneously, wireless access methods such as mobile QR codes and mobile apps are provided to enhance the mobility of course learning.

Finally, the openness and compatibility of the platform are improved to better support voice and video interaction functions, enabling learners to form a positive learning experience in an open and



interactive environment. The environment includes functional modules such as teaching resources, interactive communication, experimental systems, and teaching platforms, allowing for operations such as resource access, problem discussion and communication, experimental operation, and online testing. It can also track students' posting frequency on forums to monitor their learning status in real-time, establish a learning resource library to share learning insights and resources, facilitate the display of student work and feedback, and support learners' autonomous learning. The environment is characterized by real-time interaction, openness, and sharing, enabling learners to engage in fragmented learning and real-time interaction anytime and anywhere, thereby achieving virtualized teaching and learning. In this environment, both teachers and students are subjects, and their relationship is equal and reciprocal, allowing them to initiate topics and express opinions at any time.

### **3.2 Application of Cloud-Computing-Based Smart Environments in Foreign Language Teaching in Universities**

Theoretically, the application of cloud-computing-based smart environments involves the organic integration of traditional face-to-face teaching and modern teaching. This integration encompasses a combination of traditional and modern teaching models, various learning theories and methods, physical and online learning environments, as well as different learning styles and approaches.

Practically, the application of cloud-computing-based smart environments means a "resources-platform-practice" trinity smart teaching support environment is constructed. For foreign language teaching, this teaching support environment can be constructed in three levels: The first level involves the construction of a smart recording environment. Universities provide professional resource recording environments for various foreign language courses by constructing panoramic studios, broadcast-quality recording classrooms, and centralized observation rooms. The second level involves the construction of a smart teaching platform. By constructing comprehensive online teaching platforms, digital teaching resource centers, open online course platforms, and mobile apps, smart campus platforms provide a basic online learning environment for various resources and teaching model reforms in foreign language courses. The third level involves the construction of a smart teaching environment. By constructing various forms of smart classrooms and providing training on various teaching philosophies and models, a free and open practical environment is created for educational and teaching

reforms (Li & Wang, 2018).

In terms of application methods, in foreign language teaching, the construction of a smart recording environment provides a platform for universities to produce high-quality school-based resources. Firstly, teachers and students record open online courses, utilizing broadcast-quality automatic recording classrooms to record high-quality course resources and build large-scale school-based resources. Simultaneously, a series of activities such as subject teaching competitions, training sessions, and lectures are recorded. The construction of a smart teaching environment provides a professional digital recording platform for universities' open online courses, high-quality resource-sharing courses, and various video open courses, taking course teaching model reform to a new level. Secondly, a mobile learning platform tailored for mobile terminals such as smartphones and tablets are constructed. Students can independently complete library book borrowing and querying, electronic resource searching and downloading, library news browsing, school course learning, group discussions, and viewing university directories on the mobile learning platform. Simultaneously, the mobile learning platform is equipped with e-books, newspaper articles, and metadata of Chinese and foreign literature, providing students with convenient and fast mobile learning services. Teachers can also use the mobile learning platform for attendance checking, quick response questions, student selection, and discussions during class, making classroom teaching more convenient and efficient. Thirdly, a smart teaching platform that fully supports the entire teaching process (including courseware creation and distribution, teaching organization, teaching interaction, learning support, and teaching evaluation) is constructed. The organization and management of teaching (including user and course management), as well as integration with online teaching resource libraries and management systems, online question bank construction, online exams and grading, personalized learning, community discussions, and big data statistics, can all be achieved through the application of this smart teaching platform. This provides a complete online environment for online teaching, online Q&A, online assignments, and online exams, and offers comprehensive support from PCs to mobile devices. In smart classrooms, multimedia equipment, air conditioners, and lights are turned on in advance according to the class schedule before teachers and students enter the classroom, adjusted to optimal conditions based on temperature and lighting. A "face-recognition" attendance system installed at the classroom entrance replaces the traditional method of



teachers calling roll. The desks and chairs in the classroom can also be freely moved and combined according to the needs of teachers' classroom teaching design, facilitating interaction between teachers and students and among students. Learning resources in teachers' and students' computers and mobile terminals can be wirelessly transmitted and shared. The interactive electronic whiteboard transmits teachers' blackboard writing to students in real-time, preventing students from neglecting thinking due to taking notes. Classroom response systems enable every student to participate in classroom questions and facilitate teachers in understanding students' learning conditions in real-time. When class starts, recording begins automatically, and high-definition cameras can automatically track the teaching teacher, clearly recording the course for students to review later.

### **3.3 Evaluation of the Application of Cloud-Computing-Based Smart Environments in Foreign Language Teaching in Universities**

The application of smart environments in foreign language courses offers significant advantages. For instance, the College English course covers a wide range of content, with rapid updates and strong operability. Teaching and learning in this course within a private cloud SPOCs smart environment can leverage the guiding, inspiring, and monitoring roles of teachers in the teaching process while fully reflecting the initiative, enthusiasm, and creativity of students as the main subjects of the learning process, yielding excellent results. Smart teaching environments emphasize the availability of abundant course resources and a sound interaction mechanism. In a private cloud SPOCs smart environment, teachers' main tasks are to organize teaching resources, design instruction, provide authentic learning contexts, engage in effective teacher-student interaction, and guide students in autonomous learning to jointly complete teaching tasks. While focusing on knowledge and skill transmission, teachers should also pay more attention to cultivating learners' learning abilities, inquiry abilities, cooperation abilities, and expression abilities. For example, the content of the College English course is divided into several complementary and relatively independent modules, such as listening, speaking, reading, writing, and translation. Each module is then further divided into multiple tasks based on knowledge points, using units such as vocabulary, phrases, sentences, paragraphs, and passages. For each task, learning resources such as short videos (around 10 minutes each) and exercise banks are created for learners to study autonomously and selectively. In a private cloud SPOCs smart environment, autonomous and

collaborative learning are the mainstream, breaking away from class-based, closed learning methods and adopting open, interactive learning approaches. In smart teaching environments, teachers and students can store large amounts of data in the "cloud" without time and space limitations. As the main subjects of learning, students have access to various digital learning resources, such as short videos on course knowledge points and problem packages for listening, speaking, writing, and translation exercises. They can also obtain abundant electronic resources through the internet. The teaching objective of the College English course is to master foreign language knowledge and skills. Modular management of course resources in this course facilitates the creation and organization of teaching resources and benefits students' personalized, fragmented, or flipped learning. Students can fully utilize various learning resources provided in the environment, especially various operational task resources, to conduct operational exercises and online tests through experimental systems, checking their learning effects at any time. They can also conveniently interact with teachers and peers to resolve learning issues promptly, achieving twice the result with half the effort (Yang & Zhang, 2011).

### **IV. Conclusion**

The educational system is a dynamic and complex system filled with uncertainties, and smart education drives the continuous innovation of the educational system (Hu, et al., 2022). In the context of Industry 4.0, smart education, characterized by diversification, personalization, and intelligence, will become an important form of future education (Hu, et al., 2019). The construction of the central research-oriented smart classroom discussed in this article promotes the transformation of teaching methods for teachers and students, providing certain references and insights for educational and teaching reforms in universities. However, this is currently only an exploratory study, and further research is needed on the large-scale operation and maintenance and application of smart classrooms. In the future, universities will construct more types and quantities of smart classrooms based on disciplinary characteristics, such as multi-window, holographic, and VR classrooms. They will also explore and research the large-scale operation and maintenance of smart classrooms and the integration of multiple types of smart classrooms through specific course applications, providing data support for educational and teaching reforms and facilitating the cultivation of high-quality innovative talents in various disciplines.

Smart teaching environments and smart teaching platforms complement each other, achieving



integrated online-offline blended teaching and providing a favorable software and hardware environment for the implementation of interactive teaching. Interactive teaching regards the teaching process as a dynamic process of fusion, interaction, and influence between teaching and learning, with its core indicator being the ability to engage in three-dimensional interactive communication. It leverages intelligent mobile learning tools and application support platforms to achieve three-dimensional, efficient, and continuous interaction between teachers and students, facilitating collaboration, inquiry, and meaning construction during the interaction process, and promoting the generation and development of students' wisdom. Therefore, the author believes that in the future development process, smart teaching support environments should also focus on "application" and continuously explore new models of interactive teaching to better serve teaching and learning.

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