Construction and Simulation of a Computer-Aided Education Platform for Smart Music Classrooms based on the Internet of Things

Yifan Fan[1*] and Peixi Deng[2]

[1]Art College of Henan Institute of Science and Technology, Xinxiang, Henan 453003, China, fyf880911@163.com
[2]Recruitment and Employment Office of Henan Institute of Science and Technology, Henan 453003, China, topkiller@163.com

Corresponding author: Yifan Fan, fyf880911@163.com

Abstract. This article researches the smart music classroom and the computer-assisted education platform, expounds the development of the Internet of Things in the computer-assisted education platform, and the role of the Internet of Things in enhancing the transformation of traditional classrooms to smart classrooms. Finally, focusing on the future development, it expounds the potential of the Internet of Things in the transformation of traditional education in the future. The development trend of the computer-aided education platform in the future of the Internet of Things. A smart music classroom auxiliary education platform that is in line with the development of the smart era is proposed, it also discussed the opportunities and challenges brought by the Internet of Things technology and smart classrooms. The discussion in this article mainly belongs to the direction of practical research. The existing research results are the first point of experimental research, and the interdisciplinary research framework for the research of the intelligent music classroom computer-assisted education platform based on the Internet of Things is constructed mainly by combining the design related research results.

1 INTRODUCTION

Under the new educational situation, information technology, teaching activities, teaching methods, teaching and data management, etc., will all affect "wisdom The actual application effect of "Classroom". The essence of technology "embracing" education is no longer simply transforming

"offline" into "online", nor is it about blindly digitizing and intelligentizing the traditional teaching process. Traditional teaching classrooms are mainly manifested as: the classroom teaching mode is single, the teaching behavior cannot be analyzed, the remote teaching cannot be realized, the attendance rate statistics method is cumbersome, the students' listening status is completely subjective judgment, the teacher's participation in modern teaching is not high, and the manager lacks effective and intuitive [1]. The means to carry out teaching supervision and management. Therefore, how to promote the transition from "traditional classroom" to "smart classroom" is an urgent issue that we need to think about.

The Internet of Things is a hot vocabulary in this era, and people can deeply feel the convenience that the Internet of Things brings to individual. The Internet of Things is a product of the rapid development of information technique and an inevitable requirement for economic and social development. The essence of the Internet of Things is to achieve connection between things through the Internet, and its core still relies on the Internet, and it involves the connection between things. At present, colleges and universities are the key areas for the development of the Internet of Things. Many schools have implemented daily activities related to students, such as borrowing books and signing in to class, through the Internet of Things. With the help of the Internet of Things, the school's management of students will be easier and more convenient.

2 RELATED STUDIES

The current research on smart classrooms differs in content due to different technological developments in various countries. The research on smart classrooms in China for journal articles published in the past 10 years is relatively small before 2008. After 2008, the number of articles has risen rapidly, reaching a peak in recent years, with an average annual number of more than 50. The reason may be the rapid development of the domestic information industry this year. In particular, information technology products are becoming cheaper and personal terminals are more programmed, which reduces the cost of information generation, transmission, processing, copying, and storage. Therefore, how to use information technology to improve the learning environment has become a research hotspot.

The earliest research on smart classrooms abroad can be traced back to the "Smart Classroom" proposed by Onate et al. [2] in 2016. Foreign scholars Kwet and Prinsloo [3] believed that a smart classroom is a classroom in which information technologies such as personal computers and interactive CD-ROM video programs are embedded in traditional classrooms. Gilakjani and Rahimy [4] believed that a smart classroom is a classroom based on electronic or technological enhancement. Domestic scholars define the "smart classroom" from the learning environment. Liu [5] pointed out that the so-called "smart classroom" uses the "Internet +" way of thinking and the latest information technique to transform and increase classroom teaching to create intelligent, efficient, and A smart classroom teaching environment, through smart teaching and learning, promotes students' individualized growth and wisdom development, and solves long-standing and difficult problems in traditional classroom teaching. According to Zhang et al. [6] research on smart classroom related research covering three aspects, theoretical research, applied research and evaluation research are regarded as the first-level research topics. At the same time, combine the key themes of each article and place them under the first-level theme to form several second-level themes. Through quantitative data statistics, domestic and foreign research is mainly distributed in theoretical research and applied research, especially design research in theoretical research. The reason is that the design of smart classrooms has attracted the attention of researchers in the fields of computer and educational technology. There are relatively few evaluation studies domestic and foreign, which indicates that the claim of smart classrooms is not wide enough, and the lack of relevant evaluation studies is due to the small some of research samples. Therefore, the construction and promotion of smart classrooms requires more attention from the state, universities and teachers. The concept of smart classroom has many viewpoints at home and abroad, and various researchers elaborate on smart classroom from different angles.

The common trend is to pay attention to the use of emerging technologies to create an environment for teaching and learning, to improve personalized presentation of resources, diversification of teaching interaction, and to realize the improvement of learners' learning wisdom, which has certain research significance. Therefore, this paper builds a computer-assisted education platform for smart music classrooms based on the Internet of Things, starting from the classroom itself, based on advanced teaching concepts and real teaching situations, combined with cloud computing, many data, Internet of Things and other technologies, it is realized in an all-in-one way. Centralized intelligent recording, remote interaction, and normalized live broadcast recording provide big data support for teaching decision-making, and create an intelligent and efficient learning ecological environment.

Applied research is second only to theoretical research in the research topics at home and abroad, accounting for 37% and 35% respectively at home and abroad, indicating that the application of smart classrooms at home and abroad is still in the exploratory stage and is receiving more and more attention from researchers. With the popularization of smart classrooms, related applied research has risen rapidly since 2011. Literature analysis found that the domestic research on the second-level subject wisdom teaching model mainly analyzes the elements of teaching structure and recombines the elements of teaching and learning. The University of Reading in the United Kingdom focused on interactive technology and studied the interactive behavior of students in smart classrooms, etc. [7]. Fully considered the characteristics of smart classrooms, constructed a way of participation through interactive communication, discussion and analysis, and proposed a smart classroom teaching activity model [8].

The proportion of evaluation research at home and abroad is very low, accounting for 8% and 12% respectively. The main reason is that the smart classroom was gradually fully rolled out in 2008, and this research is still in its infancy. Related research mainly stays on theoretical and applied research, but lacks practical application. Domestic and foreign evaluation research generally includes two aspects, namely, evaluation of smart classroom teaching effect and evaluation of economic cost-benefit. Zhou Shilong, from the perspective of environmental reengineering, expressed and analyzed the evaluation criteria of "smart classroom" and "happiness education" for the establishment of independent values, and promoted the cognition of the classroom teaching model of "smart learning, smart practice, and smart generation" [9]. There is no specific evaluation system for the evaluation of teaching effects abroad, and the evaluation knowledge of each school establishes standards according to the evaluation goals of the school [10].

3   CONSTRUCTION AND SIMULATION OF A COMPUTER-AIDED EDUCATION PLATFORM FOR SMART MUSIC CLASSROOMS BASED ON THE INTERNET OF THINGS

3.1. Internet of Things Assist

The Internet of Things is a variety of information sensing equipment, real-time acquisition of information that needs to be monitored, connected, and interacted with real-time information technology. In addition to connecting real-world objects, the Internet of Things can also connect the real world and the virtual world, effectively supporting humans and machines Interaction, character interaction, social interaction between people. The Internet of Things can be broadly divided into the perceptive layer, the network layer, and the application layer. The perception layer is the infrastructure layer of the Internet of Things. It is responsible for collecting various data information of the classroom environment equipment. It consists of a variety of sensors and sensor gateways and is a source of information about the Internet of Things. The network layer uses communication networking technology including wired technology and wireless technology, such as Ethernet, Wi-Fi wireless network, cellular mobile network, ZigBee technology, etc. to connect various software and hardware devices in the classroom to form a comprehensive online and offline system [11]; At the same time, the processing perception layer acquires data

information, and stores, merges, and transmits them over long distances. The application layer is the processing layer. Create a service application platform for intelligent teaching through the mining and data processing of the perception layer data information, such as an indoor environment monitoring system, a hardware equipment control system, and an intelligent teaching management system, Figure 1.
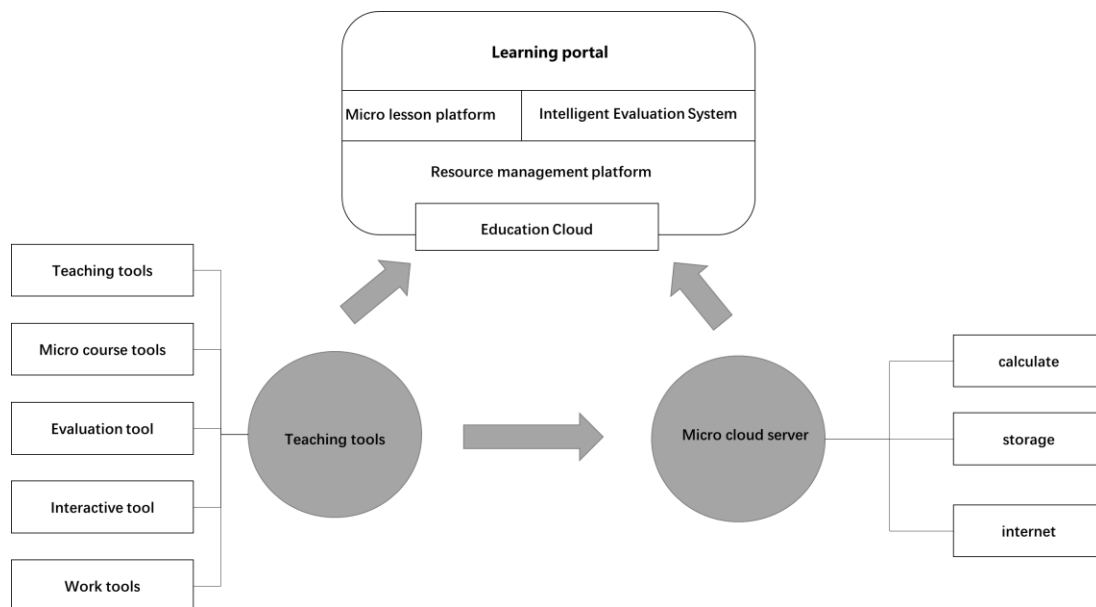
Figure 1："Cloud-Network-End" Information Platform Architecture.

3.2 Construction of a Smart Music Classroom

The popularization of the Internet of Things in the education side will lead the traditional campus to intelligentization, allowing students on campus to access the network at any terminal, realizing the convenience of the process, making management teachers more convenient and accurate management, and also safe for students' Strong guarantee. The intelligent teaching environment constructed by the Internet of Things provides teachers and students with a comprehensive and intelligent service platform, which extends the classroom to external scenes and realizes the integration of inside and outside the classroom. In the development path of the smart classroom, "data" plays a vital role. Some researchers believe that "data carries teaching (learning) thoughts, teaching (learning) action activities, and teaching results passwords are the most basic elements to promote the intelligent upgrade of the classroom." The application of various smart devices in the room has accelerated the growth of class-room teaching data. These data can watch out for the personal performance of teachers and students, and they are the basis for providing personalized learning diagnosis, accurate resource push and multiple teaching evaluation.

Therefore, "data is introduced into teaching as a tool to improve teaching, which is a distinctive feature of smart education." Comprehensive and multi-dimensional teaching data provide the possibility to explain yesterday, intervene today, and predict the learning situation of tomorrow. Through educational data mining, the "teaching in accordance with their aptitude" that the education industry has been expecting can be realized, and the most suitable teaching method can be found for every student.

With the widespread application of innovative and advanced technologies such as the Internet of Things, cloud computer, many data, and mobile internet, front-line primary and secondary

school teaching practices have been given more technical approaches and solutions, and smart teaching systems are one of them. The Internet of Things technology in the smart teaching system can be divided into four modules: classroom environment intelligent management and control, classroom environment index monitoring, classroom environment data collection, and classroom environment automatic regulation. Through the intelligent environment construction of classrooms, all digitization and materialization from environment, resources to applications are realized. So as to achieve the purpose of changing the quality of teaching and improving the level of management, improve the operating efficiency of traditional campuses, and promote the comprehensive Informa ionization of the education process.

The smart teaching system is a new way of teaching system produced by the deep combination of front-line teaching and information technique. It aims to meet the requirements of large-scale, normalized, full-disciplinary information teaching and personalized learning, and to achieve innovations between teacher wisdom and student knowledge construction. Intelligent classroom teaching created by advanced information technology uses advanced software and hardware equipment tools to intelligently control the environment, achieve personalized access and Obtain resources to promote real-time communication between teachers and students. Figure 2. The smart teaching system is developed from spatial environment design, technical tool application, teaching wisdom evaluation, etc., Take advantage of the Internet of Things, cloud computers, mobile network, many data and other technologies, through intelligent resource push, multi-screen interactive display, teacher-student interaction, and group Cooperation and discussion or other links will realize the bright management of classrooms, an implementation of teachers' intelligent teaching and the support services of students' intelligent learning, and promote the innovative development of new teaching methods.

Finally, there are various facility layers. This layer is composed of different teaching management equipment, such as smart appliances, power supplies, electric doors and windows, monitoring and control equipment, wireless access points, etc. Among them, the biometric reader can detect and perceive the changes in the smart classroom through the application of sensors, so as to remotely control the temperature, humidity, illuminance, and basic brightness of the lights in the smart classroom to achieve intelligent adjustment and control.

The smart classroom system terminal based on the Internet of Things technology can use multiple networks to realize data interaction. The smart classroom system introduced in this article is based on the differences between the roles and functions of different modules, and the system is set up as a display module, a data warehousing module, a data transmission module, and a data acquisition module, like Figure 3.

By analyzing the actual needs of the smart classroom, we can divide the network architecture of the smart classroom system into the following levels: wireless data nodes, wireless data transmission networks, and data routers. (1) Wireless data nodes: This level mainly collects and transmits related data in the classroom during the operation of the smart classroom system by setting up sensors, which mainly include the temperature, humidity, light intensity and pollutants inside the classroom ; (2) Wireless data transmission network: This level is mainly used to set up the Internet and LAN, and used for data transmission; (3) Data router: The data in the smart classroom system mainly comes from the various sensors distributed inside the classroom , And the main function of the data router is to provide these different sources of data to a unified interface, and these data are collectively transmitted to the data processing module of the system, and the data processing module analyzes and processes the collected data in a unified manner. Finally, the corresponding control instructions are given [12].
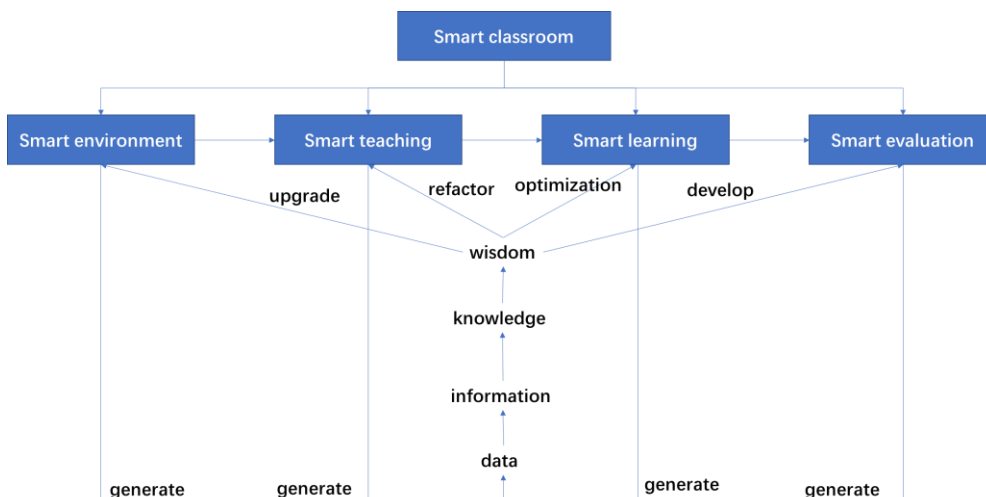
Figure 2：Mechanism analysis of smart classroom.

Figure 3：Schematic diagram of smart classroom.

4   RESULTS ANALYSIS

4.1 Computer-Aided Platform Results

Classroom screen refers to the teacher with wired / wireless technology, mobile phone or computer screen display on the screen device, in order to achieve courseware demonstration, multi-terminal synchronization, file transmission, physical photo display, touchpad control and other operations of the process.

Teachers' PPT courseware is stored in a dedicated cloud disk, and courseware can be displayed directly on-screen in classroom instruction. The screen supports multi-terminal control processes. PPT courseware catalog viewing is also supported, and you can quickly jump to the specified page.

Traditional classroom check-in more use of name-named or hand-signed way, the time required is long, statistically cumbersome. In addition to supporting the general check-in method,

in addition to the addition of scanning QR code, gestures, positioning, photography and other new check-in methods, improve check-in efficiency, but also in a novel way to increase the enthusiasm of students to participate in check-in.

Teachers in the classroom often use questions to increase students' participation in teaching activities and consider their level of knowledge of teaching content. The traditional way of selecting people often has the disadvantages of teachers' subjectivity being too high and students' participation unevenly. The selection process is randomly selected by the system, with one or more participants, and the teacher's score on the selected person can be recorded and automatically credited to the summary score.

Teaching and auxiliary resources include various teaching aids that teachers include in each chapter of the curriculum, external resources from third-party links, and reference materials such as documents, pictures, videos stored by teachers in the cloud disk. In addition to the realization of PPT courseware screen, but also can be teaching auxiliary resources quickly cast screen, enhance the richness and fun of classroom teaching content, like Figure 4.

Based on mobile-based teaching activities issued, quickly collect pre-class students preview situation, understand the ease of students to master knowledge, classroom teachers can explain the difficulties, to give guidance and feedback to students. At the same time, interactive teaching activities based on mobile, such as classroom check-in, discussion, etc., will automatically count attendance, classroom discussion and classroom performance data throughout the classroom teaching process, in addition, the data of the after-school test will be recorded throughout the teaching behavior. Through the whole process data assessment, students can better evaluate the learning effect.


Figure 4：Screencast interface of electronic resources.
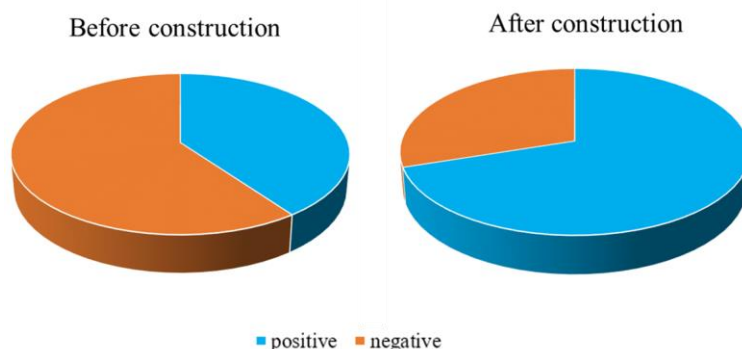
Figure 5：The enthusiasm before and after the construction of the smart music classroom.

4.2 Teaching Evaluation of Computer-Aided Education Platform Simulation

Classroom evaluation is the evaluation of teaching results and is the basis for changes in teaching strategies. The construction and implementation of the intelligent classroom need a set of evaluation system to judge and evaluate. The evaluation system can be dynamically evaluated through network, large data, cloud calculation and other techniques, which is the quality assurance of the teaching process. It is the main purpose of the evaluation system to obtain objective and accurate academic analysis and evaluation and real-time evaluation of students' learning effect, while avoiding the one-time and results evaluation of the past and focusing on process evaluation. University English smart classroom is convenient for the teaching effect of diversified evaluation, such as online student evaluation, peer evaluation, leadership evaluation, self-assessment, instant assessment of teaching, resources, ideas, skills, knowledge, objectives and so on. Compared with traditional teaching, instant evaluation is another feature of the university English intelligent classroom, and the timeliness of feedback information can teachers adapt to teaching design in time. Using the technology of many data, cloud computer and computer image processing, the data chart forms such as learning efficiency, effect, test results and evaluation results can be displayed intuitively to teachers and students, which is convenient for teaching decision-making.
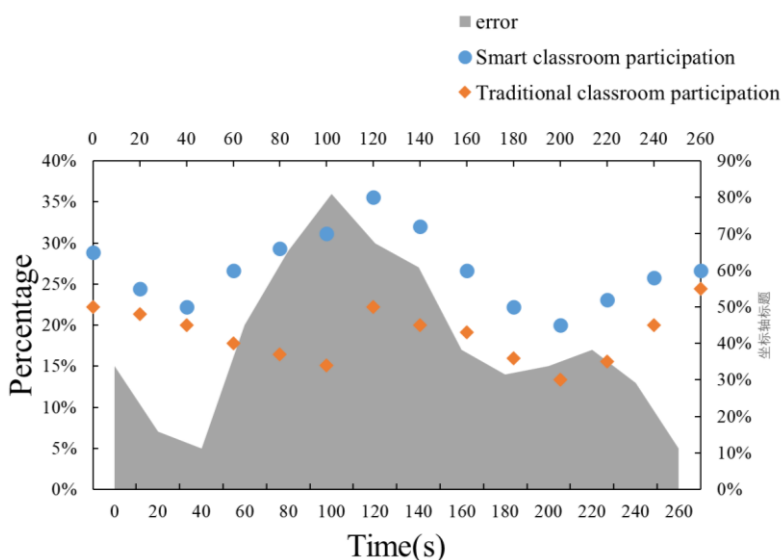

Figure 6：Smart Music Class Participation.

Implementation process	Evaluation index	Evaluation standard	Comment content
Before class	Assign a task	Is the task reasonable？	Is it suitable for the student's learning status？ Whether it can stimulate student's interest？
	Upload preview materials	Whether the network resources and teaching materials are of high quality？	Whether the teaching materials are related to the task？ Have you prepared complete network resources？ Is it a high-quality teaching material
In class	Teaching process	Is the teaching organization effective？ Whether to guide students to learn new knowledge independently?	Whether to carry out independent learning？ Whether the teaching method is innovative？ Whether the combination of personnel for task completion is reasonably grouped？ Whether to make a reasonable plan？ Efficiency and effectiveness of task completion？
	Interaction	Teacher-student interaction	Number of interactions？ Effective communication？ Whether to solve the actual problem？
After class	Evaluation	Can a reasonable evaluation of the student's learning effect be possible? Can the teaching effect be evaluated reasonably?	Evaluate whether it is diversified, real-time, and visual？ Statistics of learning process and results？ Is it scientifically complete？ Whether to evaluate individual students？
	Feedback	Can you give feedback to teachers in real time？	Is the feedback instantaneous？ Whether the feedback channels are diversified？

Table 1：Evaluation indicators of students' smart music classroom.
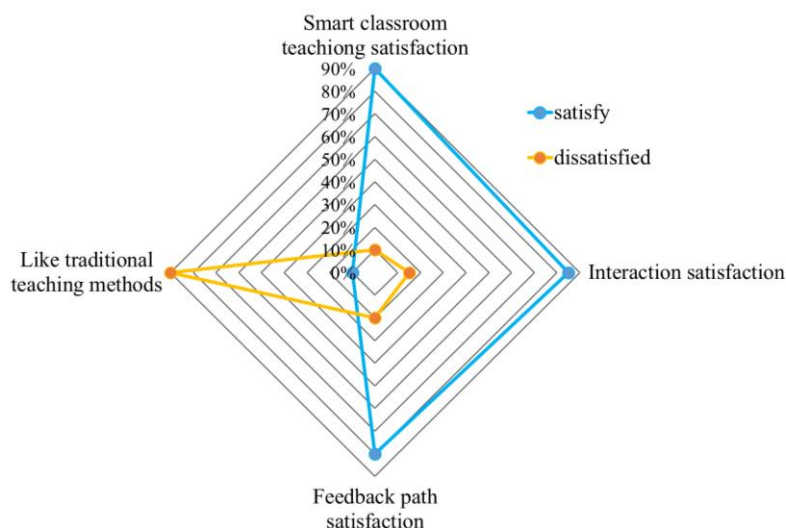
**Figure 7**：Evaluation results of students' smart music classroom.
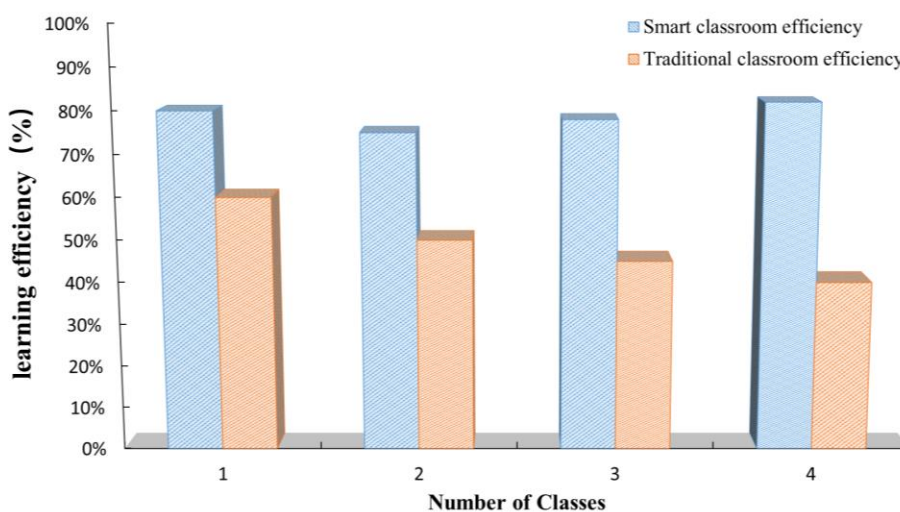
Figure 8：Learning efficiency in different classrooms.

5   CONCLUSION

Building a smart classroom can change the disadvantages of traditional education and provide a quality place for students to learn. For the construction of smart classroom environment still need to explore, and need funds and manpower as resource support, I believe that the future of smart classroom continuous improvement will provide students and teachers with a better sense of learning and working environment. Based on new media and mobile Internet technology, the new generation of intelligent classroom teaching system realizes the content of teachers' pre-class teaching preparation, students' advance review, classroom teaching and practice activities, after-school homework upload download and revision, after-school teaching consolidation and full

teaching data collection and analysis, and realizes the integration of the whole teaching system with the organic blend of online educate and offline teaching.
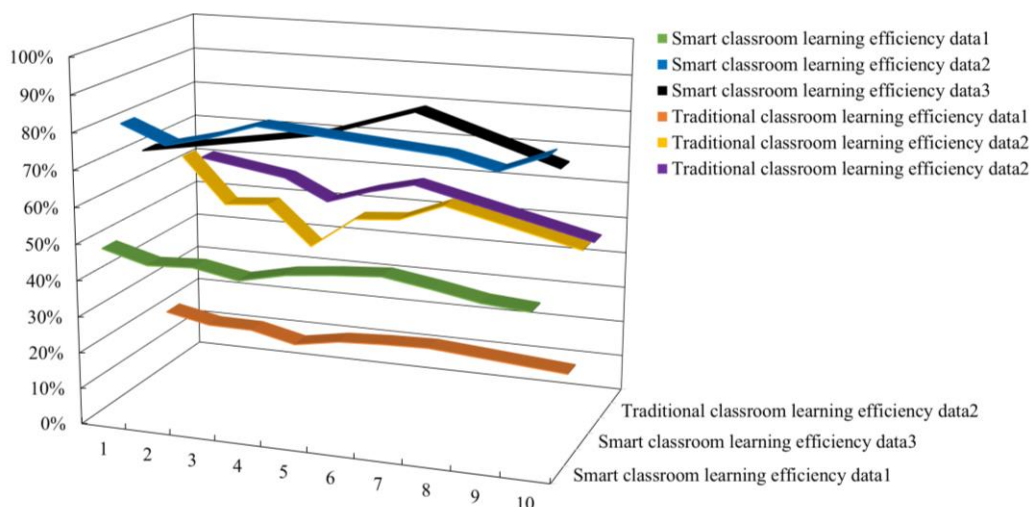
Figure 9：Daily learning efficiency in different classrooms.

The teaching method also realizes the whole teaching information collection, cloud platform big data processing analysis and real-time teaching effect feedback, and successfully realizes a complete set of information teaching ecosystem. Through the integration of new science and technique for example mobile internet, many data analysis and machine learning with traditional teaching technology, smart classrooms can be introduced into traditional teaching places, and powerful teaching databases can be accumulated in large numbers. The teaching system provides a strong supporting basis for improving the teaching quality, teaching efficiency, teaching management means and teaching reform.

Yifan Fan, https://orcid.org/0000-0002-0302-6009
Peixi Deng, https://orcid.org/0000-0003-3006-8092

REFERENCES

[1] Song, G. S.; Zhou, C. P.: The design of smart campus system under the environment of Internet of things technology, Electronic Technology and Software Engineering, 10, 2021, 167-168. https://doi.org/10.16667/j.issn.2095-1302.2017.09.028
[2] Onate, P. B.; Lara-Cueva, R.; Rivadeneira, J.: Towards a smart classroom: Development of an augmented reality application for education and tele-education, Electrical, Electronics Engineering, Information & Communication Technologies, 7, 2016, 395-400. https://doi.org/10.1109/Chilecon.2015.7400407
[3] Kwet, M.; Prinsloo, P.: The 'smart'classroom: a new frontier in the age of the smart university, Teaching in Higher Education, 25(4), 2020, 510-526. https://doi.org/10.1080/13562517.2020.1734922
[4] Gilakjani, A.-P.; Rahimy, R.: Using computer-assisted pronunciation teaching(CAPT) in English pronunciation instruction: A study on the impact and the Teacher's role, Education

and information technologies, 25(2), 2020, 1129-1159. https://doi.org/10.1007/s10639-019-10009-1

[5]   Liu, B.-Q.: Research on Smart Classroom Teaching Design and Implementation Strategies in the "Internet+" Era, China Audio-visual Education, 10, 2016, 51-56. https://doi.org/10.3969/j.issn.1006-9860.2016.10.009

[6]   Zhang, Y.-Z.; Zhang B.-H.; Han Y.-X.: Review and prospects of smart classroom research at home and abroad, Open Education Research, 20(01), 2014, 81-91. https://doi.org/10.13966/j.cnki.kfjyyj

[7]   Leidy, J.: Using Computer Assisted Instruction in an ESL Language Program, IALLT Journal of Language Learning Technologies, 15(1), 2019, 13-24. https://doi.org/10.17161/iallt.v15i1.9074

[8]   Hu, W.-X.; Tian, J.-L.: Research on the construction and application mode of intelligent classroom system, China Audio-visual Education, 09, 2011, 127-132. https://doi.org/10.3969/j.issn.1006-9860.2011.09.025

[9]   Faritha, B. J.; Revathi, R.; Suganya, M.; et al.: IoT based Cloud Integrated Smart Classroom for smart and a sustainable Campus, Procedia Computer Science, 172, 2020, 77-81. https://doi.org/10.1016/j.procs.2020.05.012

[10] Zaini, A.; Mazdayasna, G.: The impact of computer-based instruction on the development of EFL learners' writing skills, Journal of Computer Assisted Learning, 31(6), 2015, 490-496. https://doi.org/10.1111/jcal.12100

[11] Mehmood, R.; Alam, F.; Albogami, N. N.; et al.: UTiLearn: A Personalised Ubiquitous Teaching and Learning System for Smart Societies, IEEE Access, 5, 2017, 2615-2635. https://doi.org/10.1109/ACCESS.2017.2668840

[12] Yan, J.; Gui, J.-S.: Design and implementation of smart classroom based on Internet of Things technology, China Audio-visual Education, 12, 2016, 83-86. https://doi.org/10.3969/j.issn.1006-9860.2016.12.015