Smart Classroom and University Classroom Teaching Innovation

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Abstract. In multimedia classroom teaching in universities, there are such problems as monotonous teaching mode, lack of teaching and learning interaction and difficulty in carrying out teaching innovation. Characterized by rich resources, extensive interaction, combination of virtual and reality, flexibility and diversity, and perfect functions, smart classroom has opened up a new field for the creation of teaching situations, the organization of teaching activities, learning support services, precise individualized teaching and the innovation of multiple teaching evaluations. The applications of collaborative learning, game-based learning, role playing, skill operation, remote live broadcasting, STEM and Maker teaching prove that smart classroom has provided extensive and effective support for teaching innovation. The utilization of smart classroom enables teachers and students to flexibly combine, use and innovate various teaching organization forms, and jointly create new modes of classroom education and teaching to serve the cultivation of creative talents.

Introduction

The task of higher education in the new era is to realize the connotation development, and the core task of realizing it lies in improving higher education quality and train first-class talents. Classroom teaching is the main front to improve teaching quality and cultivate first-class talents, and its effect directly influences the quality of talent cultivation. The widely used multimedia classroom teaching in colleges and universities at present rose in the 1990s, and after nearly 30 years of development, PPT has been popularized in teaching. However, it is regrettable that the application of information technology in the education field is not so obvious as other fields or sectors. The well-known Steve Jobs’ Just Ask exactly raised the issue—Why has IT changed almost every field, with the exception of education? [1] Therefore, it is very necessary for us to introspect the current information technology application in classroom teaching to identify the problem, so as to “prescribe” the proper drug.

Why is it Difficult to Realize Steve Jobs’ Just Ask: Multiple Practical Difficulties in University Classroom Teaching

With Monotonous Teaching Mode, Technology has Intensified Traditional Teaching

Classroom teaching in current colleges and universities has not yet got rid of the cramming method, which only substitutes "computer + projector" for "blackboard + chalk" to use multimedia equipment just as a tool for content display. Teachers often simply present knowledge points from books or contents previously written on blackboards on the teaching equipment. Although pictures, videos, animations and other multimedia elements will be interspersed, the teaching method is still mainly instruction. This kind of teaching mode changes classroom teaching from "manual cramming" to "machine cramming" and "human-computer co-cramming", instead of changing the drawbacks of cramming teaching, which will intensify the disadvantages of traditional teaching on the contrary. The "stacking" of multimedia presentation contents and the "intermittent" display of slide page turning are more likely to make students think incoherently and have more difficulty in cognition, thus impairing teaching effect [2].

Fixed Classroom Layout has Influenced Teaching Interaction

The widely applied layout of multimedia classroom in colleges and universities is transformed with
reference to the traditional "blackboard" classroom, the platform of which is usually fixed in the front of the classroom, and the console of multimedia equipment is also arranged on the platform, while the student seats are arranged in rows against the platform. This "teacher-centered" fixed classroom layout makes teachers "saints on the platform". As teachers often have to operate the courseware at the console, their movement in the classroom is inadvertently reduced, and interaction between teachers and students is unconsciously ignored. More importantly, the current fixed "row-row" layout and boxy heavy desks and chairs in the classroom are not conducive to cooperative, discussion and research-based interactive learning, which will seriously affect interaction between students and teachers, and limit classroom teaching to the level of "listening and watching", which can only reach the low-level cognitive goal of "memorizing, understanding and partial application", but is difficult to achieve the high-level cognitive goal of "skilled application, analysis, evaluation and creation".

Lack of Intelligence in Classroom Limits Teaching Innovation

The standard configuration of multimedia classrooms in colleges and universities is "computer + projector", while students do not have learning terminals, and network connections are often limited to teachers' computer. Although some schools have equipped electronic whiteboards in recent years, they are mostly used as projection screens. Such multimedia classrooms lack intelligent elements, which are neither conducive to multi-channel resource display for teachers, nor conducive to resource acquisition and use for students, let alone learning process recording, big data analysis and individual instruction for students. Such classrooms lacking intelligent elements severely will restrict teachers and students from various "learner-centered" teaching activities such as discussion, research, practice and cooperation, so classroom teaching is difficult to get out of the traditional teaching barriers and will hinder teachers and students from teaching exploration and innovation.

Smart Classroom: A New Field of Classroom Teaching Innovation in Universities

For the multimedia classroom defects of lacking intelligence and fixed layout, education and industry have developed and built smart classroom in recent years. Smart classroom is a new type of classroom that can optimize teaching content presentation, facilitate learning resource acquisition, promote class interactive development, and has the functions of situational awareness and environmental management, which is the materialization of a typical intelligent learning environment. Supported by humanism, interaction, environmental psychology and other related theories and technologies such as intelligent space, cloud computing and ergonomics, smart classroom takes interaction as the core to give full play to the role of classroom components of human, technology, resource, environment and methodology, with the aim of building an intelligent teaching space that gives full play to the initiative, activity, harmony and free development of classroom subjects.

Smart classroom has such key functions as "intelligent large screen information presentation", "diversified and efficient interaction", "rich resource acquisition", "learning history", "equipment integration control", "creative space arrangement" and "intelligent environment control". With the humanistic design idea and advanced equipment, smart classroom is featured by complete equipment, easy operation, abundant resources, multi-screen display, diversified functions, multiple interaction and virtual-real synthesis to provide a new field and open up a new path to innovate teaching models and improve teaching quality for teachers and students.

More Conducive to Teaching Situation Creation to Enhance Sense of Immediacy

The technology equipped in the smart classroom combines real and virtual learning space, and the intelligent interactive display system provides more convenient conditions for the creation of teaching situation. Teachers can not only display teaching contents with large screen to give students an immersive and shocking teaching experience, but also be use multiple screens to present different teaching resources for a knowledge point, so that students can learn from multiple angles and levels with different senses. The intelligent interaction and intelligent terminal of interactive
display system as well as virtual reality and somatosensory device can also be used to enhance the sense of immediacy for students to provide them with multi-channel and multi-level teaching experience to achieve more smooth, harmonious and unified teaching interaction.

More Conducive to Organizational Form Innovation of Teaching Activities to Expand Teaching Space

The rich teaching resources, extensive interactive environment, ubiquitous network connection and free-changing learning space provided by smart classroom can provide a wide space for the organization and implementation of various teaching activities. Teachers can use flexible desks and chairs to change the classroom layout easily to create group, set up stage and carry out group cooperation, role play, impromptu debate, brainstorming, reporting speech and other "learner-centered" teaching modes. Teachers and students can use AR and VR systems equipped in smart classroom for practical experience, and can use 3D printing system to create practice and carry out "learning by doing". In addition, teachers and students can also use ubiquitous network and intelligent terminal to carry out mixed learning such as resource sharing and flipped classroom, as well as remote live collaborative learning to combine online and offline, inside and outside school to break the school walls and expand the teaching space.

More Conducive to Form Wide Learning Support Services to Promote Education Equity

Intelligent terminal, screen projection system, answering system and random roll call equipped in smart classroom will provide more opportunities for students to participate in teaching activities, greatly increase the radiation of students’ participation in teaching and contribute to the realization of education equity; Meanwhile, the devices will provide more channels for interaction between teachers and students as well as students and students for more rapid and perfect teaching feedback, which is conductive for teachers to understand the learning situation of students in time to provide them with assistance and guidance. In addition, the open environment provided by smart classroom makes it easy for learners to seek help when they are faced with difficulties. The help can come from teachers and peers on site, as well as from online learning support system and remote teachers, companions, experts and others. The extensive learning support service is more convenient to meet different needs of learners to better help them complete the learning process.

More Conductive to Carry Out Accurate and Personalized Teaching to Stimulate Learning Potential

With the combination of learning process record of smart classroom and big data analysis of cloud platform, the learning situation, learning habits and learning needs of students can be more comprehensively understood. Data analysis and mining techniques such as electronic portfolio, learning analysis and student models can provide students with more accurate customized services, recommend learning resources, formulate learning plans, provide learning suggestions and supervise the completion of learning. The intelligent agent can also carry out intelligent interaction and dialogue with students to provide personalized intelligent services and help them to carry out autonomous learning, promote in-depth learning and stimulate learning potential. Teachers can also pay more attention to each student through the data platform and provide them with adaptive learning support and more personalized learning guidance.

More Conducive to Multiple Learning Evaluation to Improve Comprehensive Quality

Learning evaluation is the examination and assessment of the expected learning effect. Learning evaluation mainly includes formative evaluation, diagnostic evaluation and summative evaluation. Teachers and students can use the intelligent terminal in smart classroom to conveniently carry out formative evaluation such as testing and investigation, or easily make record and collect data in real time through the whole learning process relying on the intelligent recording and broadcasting system and intelligent console, so as to conveniently carry out diagnostic and summative teaching evaluation and reflection. Teaching environment of smart classroom makes the learning evaluation modes more abundant and the evaluation means more diverse. It is not only composed of traditional
evaluation, but also new evaluation methods such as network and video based on individual (students and teachers) evaluation, group evaluation, or evaluation from groups and learning collective. As it were, this multiple learning evaluation can involve almost all levels of teaching. Through these more objective and specific multiple evaluations, students’ development can be further understood, thus helping them to bring out their strengths and make up weaknesses to improve the comprehensive quality.

**Typical Applications of Classroom Teaching Innovation in Smart Classroom**

Smart classroom has gathered the latest scientific and technological achievements to integrate physical space, resource space and social space organically, which creates very favorable conditions for developing a new teaching mode characterized by "student-centered" autonomy, exploration, interaction and cooperation, and realizes the grand goal of educational informatization. However, it also requires teachers to actively explore and practice teaching reform and innovation in teaching so as to change the teaching structure and teaching mode to serve the cultivation of innovative talents. The typical application modes of teaching innovation in smart classroom mainly include:

**Collaborative Learning**

Collaborative learning is a strategy for learners to organize learning in groups or teams in order to achieve common learning goals. Group collaborative learning is one of the most commonly used teaching organization forms in smart classroom, which can be summarized as "setting task - defining division - independent exploration - group discussion – works demonstration - evaluation and retrospection". Smart classroom has created very convenient conditions for collaborative learning. Creative desks and chairs can provide flexible grouping, intelligent interactive systems with complete functions and intelligent terminals held by each student can provide more convenient tools for independent exploration and group discussion, while the whole-process intelligent recording and broadcasting system can provide material and guarantee for evaluation, reflection and repeated learning, all of which make collaborative learning more flexible, convenient and easy.

**Game-based Learning**

The German educator Froebel believes that "As a manifestation of self-activity within a person, game is unique to the whole life of a person. Game gives people joy, freedom, satisfaction, peace and tranquility inside and outside". Therefore, regardless of age, people always enjoy playing games. The introduction of games into teaching is to take the born psychology of people's love of games to integrate the cultivation of knowledge and skills into games so as to gain new cognitive and emotional experiences in a relaxed and happy atmosphere.

In previous traditional classroom environment, "it is not very easy to bring games into education", but smart classrooms built with new ideas and technologies offer more possibilities to carry out games. The interactive touch display screen and networked intelligent terminals in smart classroom provide good material and technical support to carry out game-based learning. On the one hand, teachers and students can carry out digital game learning activities in virtue of these devices, and on the other hand, relying on the desks and chairs freely arranged in smart classroom, they can change the classroom composition style at will to provide venue support and carry out various game-based learning (such as brainstorming, word answering, group answering, etc.). The process of game-based learning includes "game planning - game preparation - defining rules - game playing - summary evaluation". Firstly, teachers or teachers and students can determine the game plan jointly according to the teaching content to prepare the game space and game software under the plan with the smart classroom environment to carry out actual game activities after defining rules. The game can be completed either individually or in groups or collectively, then be summarized and evaluated, and the recorded activity video will be uploaded to the cloud resource platform for review and teaching reflection after class.
Role Playing

Role playing is a comprehensive and creative activity. Students can quickly gain perception and experience by playing a certain role, so as to build up new understanding and knowledge to cultivate the ability of social life. The teaching process of role playing can be summarized as "theme determination – roles assignment – material preparation - performing in groups - evaluation and retrospection". Teachers and students determine the performance theme according to the teaching content, and students define the performance role through self-recommendation, negotiation or electronic draw, then use intelligent terminals, cloud resource platforms and mobile desks and chairs to prepare the performance materials and venues. During group performance, they can use intelligent recording and interactive display systems for live broadcasting and recording, and use intelligent terminals and electronic voting systems for on-site comment, interaction and scoring, so as to increase students' participation and involvement. Finally, teachers and students can evaluate and comment on the whole performance activity through playing back the performance video, viewing comment records and publishing comments and electronic voting.

Live Classroom

Traditional classroom teaching confines teaching to a fixed place and is implemented by a teacher facing the same group of students in a classroom. With the emergence of smart classroom, teaching can easily break through regional restrictions and expand teaching to different places. Live classroom is a teaching mode to use recording, broadcasting and network devices of smart classroom to carry out live and interactive classroom activities in the whole process between the "main classroom" where the lecturer is located and several remote "sub-classrooms". Live classroom has crossed regional boundaries to enable students in different spaces to learn together in one classroom at the same time, and even to carry out cross-border learning. This teaching mode will expand the teaching space, broaden students’ vision, and also provide a feasible and effective way to promote educational balance. Schools can use the live broadcast classroom for multi-campus teaching, urban and rural teaching, give full play to the role of outstanding teachers, enable the share of outstanding teaching resources, and solve the problem of unbalanced resource distribution and unreasonable allocation.

STEM and Maker Teaching

In the current intelligence-oriented "Industry 4.0" era, the traditional and single-discipline teaching method can no longer meet the needs of innovative personnel training. STEM (Science, Technology, Engineering, Mathematics) education is precisely the educational model put forward in the United States forced by the talent requirement for social upgrading. STEM education advocates problem-solving interdisciplinary education and focuses on cultivating students' comprehensive problem-solving ability. STEM education has been widely accepted by the world education field as soon as it was put forward, and has developed new interdisciplinary comprehensive education models such as STEAM, STEM + Maker, etc. Smart classroom and STEM education complement each other and can well support and interpret STEM education. The complex and flexible design of "creative space" in smart classrooms can easily reconstruct and combine various forms of space through mobile partitions, portable desks and chairs and movable equipment to provide environmental support for exploration, cooperation, project-based learning and design-based learning in different scenes. The hardware and software systems and equipment such as multi-screen display, intelligent terminal, cloud resource platform and 3D printing equipped in smart classroom can provide independent exploration, information sharing, discussion and interaction, product construction, display and communication, mutual learning and progress, retrospection and iteration for the comprehensive application of STEM and Maker education, which are of high importance to improve students' ability to solve complex problems and promote the higher-level development of students' cognitive ability.

The teaching organization forms applied in smart classroom are far beyond those mentioned in the article, and the teaching organization forms are not used in a single and isolated way. We should...
take the "students-centered" idea according to different subject courses and teaching contents to pay attention to the knowledge exploration process as well as development of cognition, skills and emotions of students to combine, apply and innovate flexibly to achieve the best teaching effect.

**Summary**

Having gathered the latest scientific and technological achievements, smart classroom creates a broad creative space for classroom teaching reform and innovation, which is the inevitable trend for the development of teaching environment in the information era. However, new technology will not naturally produce educational miracle, but requires teachers and students to exert group wisdom in teaching practice, dare to try and keep exploration to jointly create a new mode of classroom teaching to serve the cultivation of innovative talents.

**References**


