Chapter 5
Smart Learning in Classroom Environment

Abstract Smart classroom is a typical environment for smart learning, and it is the high end form of digital classroom. This chapter is presenting the process of creating smart classrooms in China. Firstly, the trends of ICT in classroom is analyzed. Secondly, the status of multiple types of classroom (multimedia, computer, interactive white board and tablet computer classrooms) is analyzed. Thirdly, ways to build smart classroom are discussed from classroom equipment, spatial arrangement, teaching application, and cases.

Keywords Smart classroom · Learning experience · Construction of classroom · The trend of smart classroom

5.1 Introduction

The immediate task for education is to embrace the future, and empower our children to learn with the cultural tools they have already been given (Soloway 1991). In China, a batch of education ICT-based projects has been launched successively since 2000, and great development has been achieved in the area of creating educational system based on ICT infrastructure. Since 2010, more attention was paid to building classroom learning environment based on ICT. Governmental policies have been proposing that the classroom environment supporting technology will be the important element of ICT-based education. Starting from 2000, ICT has been placed on the education reform agenda both as an object of education, and as an important pedagogical tool for innovative teaching methodology (Peeraer and Van Petegem 2015). As argued by Williams (2005), extrapolations from emerging trends can have a value in promoting understanding of the present situation, as well as in identifying needs for the future. ICT is one of the most visible symbols of globalization and educational innovation (Power 2007). Implementation of ICT is often presented as 'inevitable' (James and Hopkinson 2009) and increasingly ubiquitous. The integration of ICT with education is moving beyond getting

D. Liu et al., *Smart Learning in Smart Cities*, Lecture Notes in Educational Technology, DOI 10.1007/978-981-10-4343-7_5

personal computers into the hands of learners and towards mobile technology, virtual world, and cloud computing amongst others (Hong and Songan 2011).

Each generation, has a distinctive 'generational consciousness', which is dependent on the pace of social change (Erstad 2010). The implications of such generational divides are further popularized in Tapscott's book 'Growing up digital. The rise of the Net generation' (1998), and with a recent follow up called 'Grown up digital' (2008), and a similar book by Palfrey and Gasser termed 'Born digital' (2008). Digital generation of learners is good at utilizing technology and pay attention to teamwork and practical operation, and prefers new learning methods, such as autonomous learning, exploration and cooperation, pursuing for innovation (Huang et al. 2014). The features of smart learning, such as smart perception, strong interaction and high immersion, earn appeal to digital learner's learning needs (Huang et al. 2012). However, the traditional classroom environment is not beneficial to the development of smart learning, and the learners have relatively low satisfaction from learning experience in current classroom environment. The performance level required from the smart classroom is far more complex than the one required in traditional classroom teaching (Ringstaff et al. 1991).

In the information age, with the sufficient development of sensor technology, network technology, media technology and artificial intelligence technology, the classroom environment becomes the "net type of classroom which can optimize teaching content presentation, be convenient for learning research obtaining, promote classroom interaction development, with context awareness and environment management function". Smart classroom is a typical materialization of smart learning environment, and is the high end form of network classroom, where the "intelligence" involves five dimensions: Showing, Manageable, Accessible, Real-time interactive and Testing, abbreviated as "SMART" conceptual model, shown as Fig. 5.1 (Huang et al. 2012).

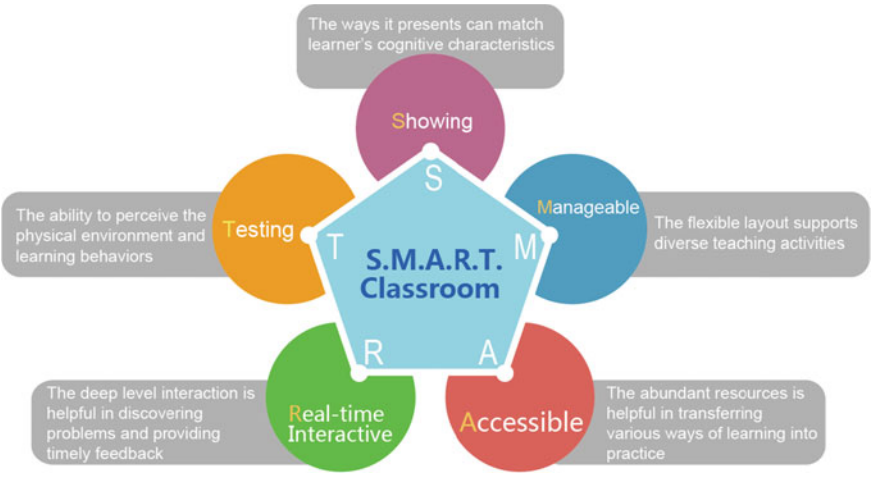

Fig. 5.1 The concept of "SMART" classroom

With the development of smart classroom, some trends emerged in the building digital classrooms in China, which will be illustrated in the next section.

5.2 The Trends of ICT in Classroom

The teaching environment will change with the development of smart classroom. Since the highly development of Internet, teaching content has change from the traditional one-way teaching into the bidirectional interaction, teaching environment will change from the vivid field teaching into the virtual classroom, and teaching contents will also change from single to multiple applications. Traditional classrooms often involve several drawbacks due to limitations of formal learning (Novosadova et al. 2007). With the development of information technology, as well as mobile devices, the transformation of the education and teaching has been changed, especially with the appearance of flipped classroom, the concept of smart classroom has been already introduced in more and more countries. Smart classroom can promote the construction of traditional classroom. In the coming years, we infer that there will be five trends under the influence on the development of smart classroom.

5.3 Applying Innovative Artificial Intelligence in Education: Learning Companion and Smart Classrooms

A growing number of educational studies apply sensors to improve student learning in real classroom settings. However, how can sensors be integrated into classrooms to help learners improve their learning effectiveness? One way to solve this problem with AI is learning companion with sensor technologies. Timms envisions smart classroom that make use of sensors to support learning and illustrates how they might be used in new ways if AIED (Artificial Intelligence in Education) applications are embedded into them (Timms 2016). Learning companions provide both task-related feedback and motivational support for students with the goal of improving learning, such as education robot (Lubold et al. 2016). As robots become increasingly pervasive, filling every aspect of life, at home, at work, at school, they can offer continued and individualized support in cases where it is not always possible to have a constant human companion. With this growing number of applications involving social human-robot interactions, there is a growing need for adaptive and personalized learning. Through cloud computing, network technology and response systems and other technology, smart classroom can support the development of adaptive and personalized learning.

5.4 Transforming Teaching Mode

The future perspectives of smart learning environments are reviewed and shared, through examples of emerging innovations such as the flipped classroom, game based learning, gesture base learning, along with pedagogical shifts, such as life-long learning portfolio maintenance, team teaching, and separation of learning and competency assessment. (Kinshuk et al. 2016). Therefore, in order to improve the students' learning autonomy, the current teaching mode need to be changed, such as the task driven teaching mode, which was increasingly recognized and promoted by colleges and universities. Duanyuan et al. give an example of task—driven teaching automation specialty, they show that task—driven teaching can integrate more dispersed knowledge in a teaching task that requires students make integrated use of key knowledge points to complete the task, thus effectively mobilize the participation of students' consciousness (2016). Task-driven teaching mode is very suitable for the smart classroom. Project-based teaching mode also can be integrated into smart classroom. The history of PBL can be traced back to the progressive tradition advocated by John Dewey. Dewey insisted on the idea of "learning by doing". He argued that the classroom should be a kind of society and the students should be encouraged to become the center in the learning process. Project is an extended task which usually integrates skills through a number of activities (Hedge 1993). Project-based learning (PBL) is yet another way technology can be utilized to facilitate STEM learning in ways that align with real-world practices. With the change of smart classroom, the traditional teaching mode also need to be changed.

5.5 Preparing Teachers and Students for Smart Classroom

In a smart classroom, the role of the teacher has changed from being a performer to a designer and director of learning situations. This new situation is also a challenge for lecturers at teacher training programs. Now they have to design learning situations promoting practical skills of the students in the pre-service training to make them became teachers working according to the new curriculum and technologies (Mattsson and Mutvei 2015). European Commission (2006) defines competence as the combination of knowledge, skills and attitudes that a person must have to successfully develop and participate in the knowledge society. Teachers also need to consider employing various strategies to enhance positive relationships with students in order to facilitate more effective learning experience and vary strategies for enhancing satisfactory relationship with students depending upon different learning environment (Song et al. 2016). Both students and teachers need a change in their teaching ability and learning ability, thus learn how to make good use of

technologies is a key point. Future more, teacher training for smart classroom is also in a hurry, they need to know how to keep up with the new technologies and teaching mode.

5.6 Combining STEM with Smart Classroom

Technology use in the classroom has great potential to transform student learning. This is particularly true for science, technology, engineering, and mathematics (STEM) workplace applications of technology, such as robotics, computer modeling and simulations, digital animation, multimedia production, biotechnology, and geospatial technologies (Parker et al. 2015). These applications offer opportunities to align classroom activities with real-world STEM practices, while engaging students in authentic investigations and design-based pursuits and promoting student-centered learning and interest in STEM careers (MaKinster et al. 2014; Miller et al. 2011). Technology applications can provide opportunities for tackling these high-quality STEM practices through interactive learning opportunities that mirror professionals' use of digital tools (Moeller and Reitzes 2011). Integration of STEM workplace applications of technology into K–12 smart classrooms presents significant challenges for education.

5.7 Integrating Maker into Smart Classroom

The development of technologies such as 3D printing, open source electronics, and accessible programming environments has given rise to a despecialization of aspects of prototyping and production so that broader populations can participate in 'do-it-yourself' (DIY) activities once reserved for technology experts (Chu et al. 2015). This phenomenon has spurred interest in the use of Making in educational settings to teach such STEM (Science, Technology, Engineering and Mathematics) curriculum content as science, engineering, electronics, robotics, and mathematics, and to encourage children to pursue STEM careers later in life. Making oriented learning needs not be constrained to the assessment of specific skills and knowledge sets. Maker address problems by seeking 'do-it-yourself' solutions, a belief that they either have or can acquire the means to construct a solution, and possess a creative curiosity to seek solutions that the Maker can construct on her own (Chu et al. 2015). Martinez and Stager describe Making as the "act of creation with new and familiar materials" where one takes control of their life and their learning (Martin and Dixon 2013). In order to combine making oriented leaning and smart classroom together, the school need a set of equipment, a specific method, a bounded place, or even a community of practitioners. It is a whole culture that celebrates certain key values of personal production and problem solving.

The development of classroom environment is closely related to the policies in our country. For example, the "Shanghai Medium and Long Term Educational Reform and Development Planning Outline (2011–2020)" mentions that in five years Shanghai plans to develop and construct the instructive, interactive and systematic digital teaching system beneficial for self-regulated learning and. By the end of March of 2015, the implementation of "connect classes[1] with quality digital learning resources" had an obvious effect: 73% of the schools have owned multimedia classrooms, and 43% of the schools created multimedia classroom. Other provinces and regions have the same situation. The next section will introduce the overall status of classroom environments in China with abundant data analysis.

5.8 The Status of Classroom in Chinese Schools

To understand the status of classroom environment, we will consider two factors. Firstly, we will analyze the issue of hardware equipment, as the perfect and complete equipment is the basis for a digital classroom. Secondly, we will analyze how schools develop cloud service system, as availability of network resources is beneficial for students.

The types of classroom environment include multimedia classroom, computer room, interactive white board classroom and tablet computer classroom. Therefore, the status of digital classroom in this chapter is described from four aspects: multimedia classroom, computer room, interactive white board classroom and tablet computer classroom.

The data about multimedia classroom, computer room and tablet computer classroom are from the 2014 educational statistics released by the Development Department of the Ministry of Education of the People's Republic of China.

The data about interactive white board classroom are from the "Chinese Electronic Whiteboard Market Analysis Report", released in recent years by China Market Research Group. The sales data of whiteboard from the report are utilized to conduct analysis on the implementation of interactive white board classrooms in our country.

[1]The concept "Connect Classes" means equipping the classes with moderate ICT-based equipment and network facilities, and equipping schools with corresponding ICT-based teaching resources. Connect Classes is implemented as one of the important policies mentioned in "National Plan for ICT in Education (2011–2020)".

5.9 Implementation of Multimedia Classroom in Chinese Schools

5.9.1 Multimedia Classroom in Primary School

The coverage rate of multimedia classrooms of primary schools in various regions throughout the country is shown in Fig. 5.2. The coverage rate of multimedia classrooms in primary schools of Zhejiang, Beijing and Shanghai is relatively high, more than 90%, and the coverage rate of Gansu, Xizang, Guangxi and Henan is lower than that of the average level of the whole country.

5.9.2 Multimedia Classroom in Junior High School

The coverage rate of network multimedia classrooms of junior high schools in various regions throughout the country is shown in Fig. 5.3. The coverage rate of network multimedia classrooms in junior high schools of Shandong, Shanghai, Beijing and Zhejiang is relatively high, higher than 80%, and the coverage rate of Xizang, Sichuan and Hunan is relatively low.

Fig. 5.2 Coverage rate of network multimedia classroom of primary schools of various regions throughout the country

Fig. 5.3 Coverage rate of multimedia classrooms in junior high schools of various regions throughout the country

Fig. 5.4 Coverage rate of network multimedia classrooms of regular senior secondary school of various regions throughout the country

5.9.3 Multimedia Classroom in Senior High School

The coverage rate of network multimedia classrooms of senior high schools in various regions throughout the country is shown as Fig. 5.4. The coverage rate of network multimedia classrooms of ordinary senior high schools of Zhejiang, Beijing, Shanghai, Jiangsu and Ningxia is relatively high, higher than 80%, and the coverage rate of Xizang, Qinghai and Anhui is relatively low, lower than average level of the whole country.

5.10 Implementation of Computer Classroom in Chinese Schools

The number of computer rooms reflects the basic ability of schools to utilize ITC-based means to develop teaching activities. According to the 2014 educational statistical data[2] released by Development Department of the Ministry of Education of the People's Republic of China, there are great differences of the computer room area occupied by each 10 thousand students between various regions and learning stages.

5.10.1 Computer Classroom in Primary School

The Fig. 5.5 illustrates the space used by computer rooms per 10 thousand students of primary schools. In Ningxia and Shaanxi, the space is bigger (with the area of 2013 m^2 of Ningxia and 2004 m^2 of Shaanxi), while in Guangxi and Jiangxi the space is relatively smaller.

5.10.2 Computer Classroom in Junior High School

Figure 5.6 illustrates the space used by computer rooms per 10 thousand students of junior high schools in various regions. In Jiangsu and Shanghai the space is bigger (4218 m^2 of Jiangsu and 3455 m^2 of Shanghai), while in Guangxi and Guizhou the space is relatively lower.

[2]Data sources: http://www.moe.edu.cn/s78/A03/moe_560/jytjsj_2014/.

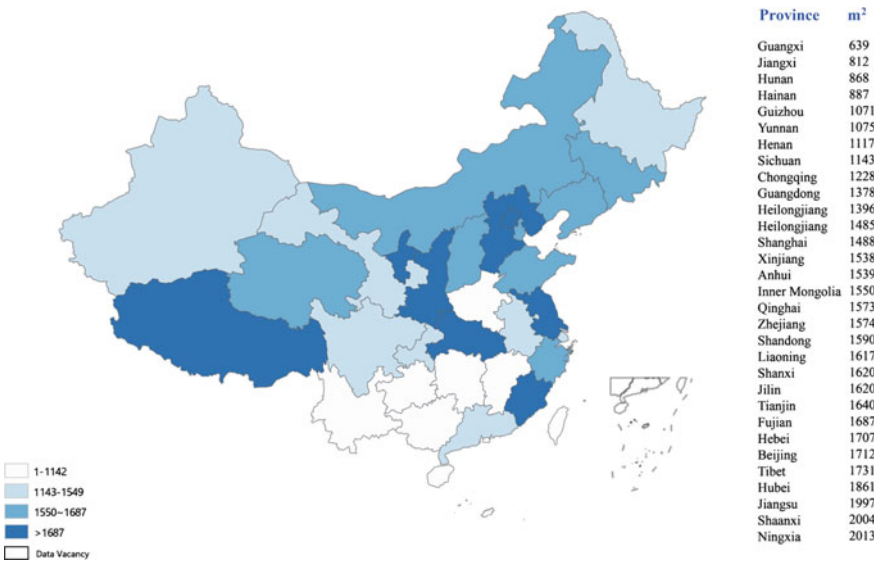

Fig. 5.5 Computer room occupation area of 10 thousand students of primary schools in various regions (m^2/10 thousand people)

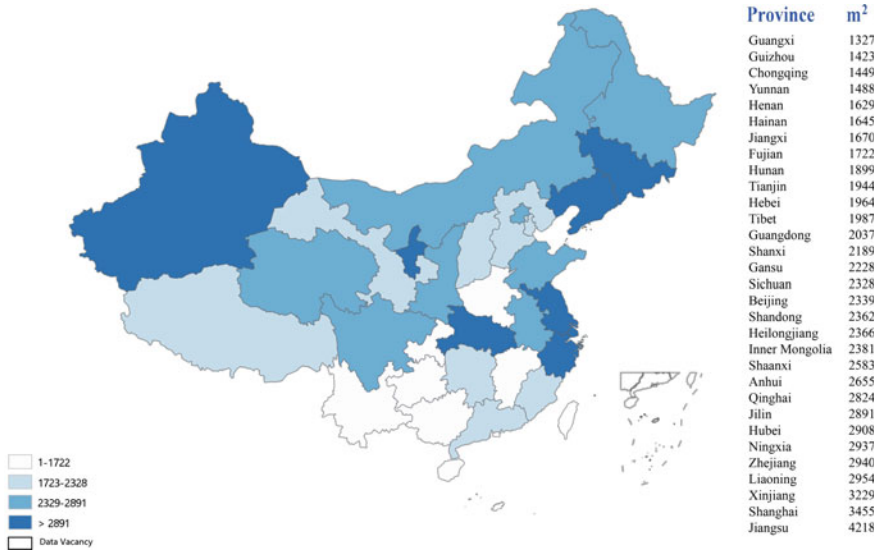

Fig. 5.6 Computer room occupation area of 10 thousand students of junior high schools in various regions (m^2/10 thousand people)

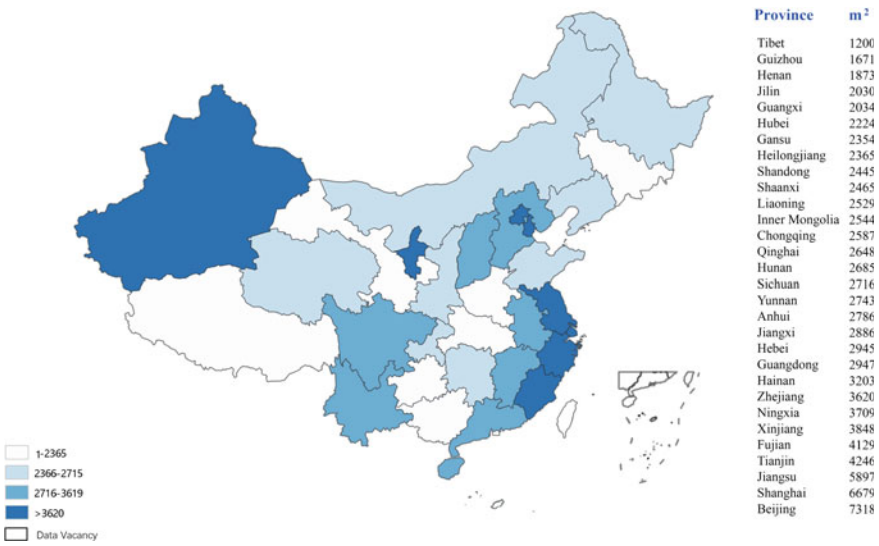

Fig. 5.7 Computer room occupation area of 10 thousand students of senior high schools in various regions (m^2/10 thousand people)

5.10.3 Computer Classroom in Senior High School

Figure 5.7 illustrates the space used by computer rooms per 10 thousand students of senior high schools in various regions. In Beijing and Shanghai the space is relatively higher (7318 m^2 of Beijing and 6679 m^2 of Shanghai), while in Guangxi and Guizhou the space is relatively lower.

5.11 Implementation of Interactive White Board Classroom in Chinese Schools

The construction of interactive white board classrooms is the embodiment of the implementation of ITC-based education into construction of digital classroom environment. It reflects the basic ability of schools to utilize ITC-based means in teaching activities. In consideration that 95% of the white boards sales in our country is used for education, we analyzed the sales data of electric white boards, presented in "Analysis Report to Electric White Board Market Development in China" released in 2012–2014.

We found out that the total holding quantity of electric white boards in various regions of our country is not high, and there is obvious difference between the holding quantity of interactive white boards in various regions.

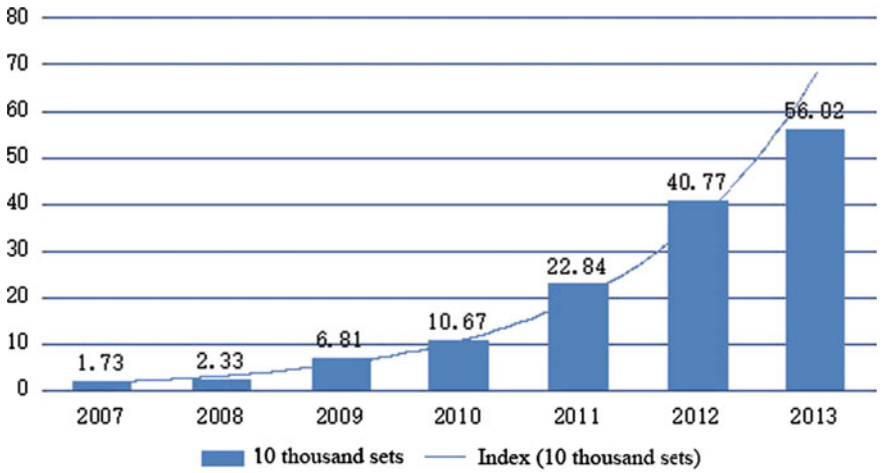

Fig. 5.8 Nationwide sales of electric white boards in the period of 2007–2013

5.11.1 Interactive White Board Classrooms Throughout the Country

The amount of interactive white board classrooms in our country has gradually increased, with qualitative change from 17.3 thousand sets in 2007 to 560.2 thousand sets in 2013, as shown in Fig. 5.8.

According to the statistics from the year 2013, based on the quantity of electric whiteboards used for education, and the quantity of multimedia classrooms in 2013, the proportion of the multimedia classrooms and interactive white boards is relatively low (about 1/3), as shown in Fig. 5.9.

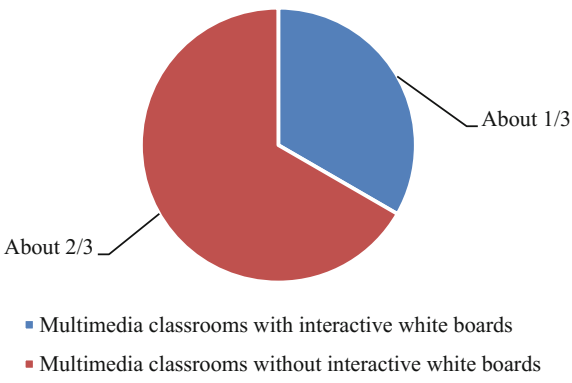

Fig. 5.9 Proportion of multimedia classrooms with interactive white boards in 2013

Fig. 5.10 Quantity of interactive white board classrooms owned by 10 Thousand students in various regions

5.11.2 Interactive White Board Classrooms in Different Regions of China

The use of interactive white board classrooms in various regions of the country is shown in Fig. 5.10. The quantity of interactive white board classrooms per 10 thousand students in Beijing and Shanghai is relatively higher (Beijing is the highest), and the quantity of interactive white board classrooms per 10 thousand students in Jiangxi and Chongqing is relatively lower.

5.12 Implementation of Tablet Computer Classrooms in Chinese Schools

Equipping classrooms with tablet is the embodiment of the intelligent classroom environment. Considering that the smart classroom construction in our country is still in exploratory and developmental stage, the quantity of tablet computer classrooms is relatively small. We analyzed the data about the quantity of tablet computer published in 2014 education statistic data[3] released by Development Department of the Ministry of Education of the People's Republic of China.

[3]Data sources: http://www.moe.edu.cn/s78/A03/moe_560/jytjsj_2014/.

We found out the quantity of tablet computers in various regions of various leaning stages in our country is not sufficient, and there is obvious difference of the quantity of tablet computers per 10 thousand students between various regions.

5.12.1 Tablet Computer Classrooms in Primary School

The quantity of teaching tablet computers per 10 thousand students of primary schools in various provinces is shown in Fig. 5.11. In Beijing and Liaoning the quantity is relatively bigger, and in Hainan and Yunnan the quantity is relatively smaller.

5.12.2 Tablet Computer Classrooms in Junior High School

The quantity of teaching tablet computers per 10 thousand students in junior high schools in various regions is shown as Fig. 5.12. In Beijing the quantity is relatively bigger, and in Inner Mongolia and Yunnan the quantity is relatively smaller.

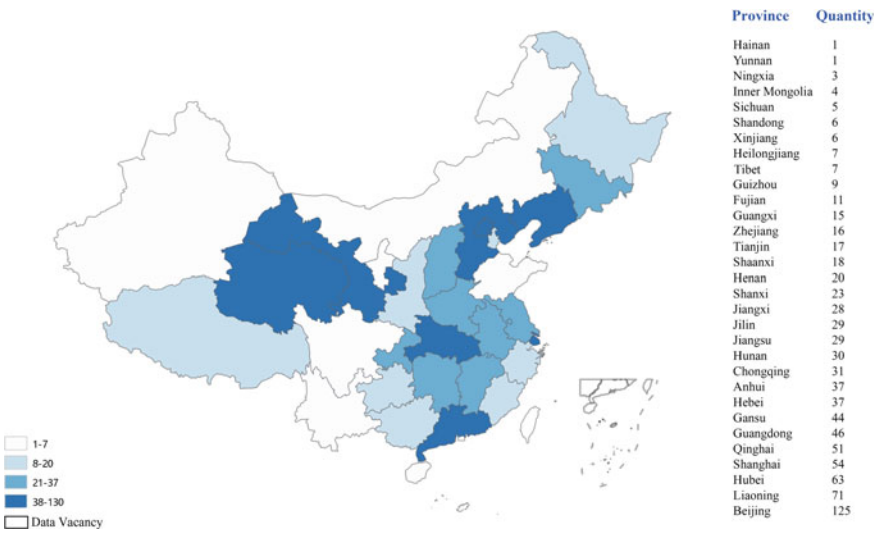

Fig. 5.11 Quantity of teaching tablet computers owned by 10 thousand students in primary schools in various regions

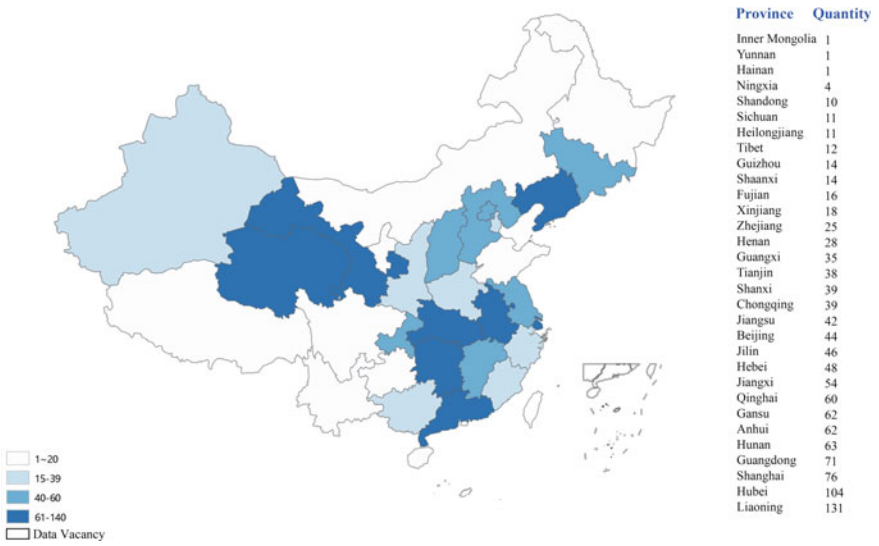

Fig. 5.12 Quantity of teaching tablet computers owned by 10 thousand students in junior high schools in various regions

5.12.3 Tablet Computer Classrooms in Senior High School

The quantity of teaching tablet computers per 10 thousand students in junior high schools in various regions is shown as Fig. 5.13. In Beijing the quantity is relatively bigger, and in Inner Mongolia and Yunnan the quantity is relatively smaller.

Fig. 5.13 Quantity of teaching tablet computers owned by 10 thousand students in junior high schools in various regions

5.13 Ways to Build Smart Classrooms in China

From the analysis of the status of classroom, we understand the status of multimedia classrooms, computer room classrooms, interactive white board classrooms and tablet computer classrooms in China. Combined with the trends of ICT in classroom and the status, we proposed some ways to upgrade different types of classroom environments.

5.14 Upgrading Multimedia Classroom

As a widely used classroom type, the multimedia classroom will be changed in the future. The upgrading of smart classrooms is analyzed below from four perspectives: classroom equipment (what mainly refers to the supply of hardware, spatial arrangement, teaching application (what refers to the method of integration between classroom equipment and teaching in new generation of classroom environment), and typical cases (what introduces the case of successful teaching in certain classrooms).

5.14.1 Classroom Equipment

Multimedia classroom is a type of classroom with relatively high coverage rate at present. This type of "high-definition display" classroom can well support the development of the "transmitting-accepting" teaching model. It is especially suitable for the basic teaching process of knowledge content concentrated teaching and it will be widely and generally utilized in the future. The equipment configuration situation of multimedia classrooms is shown as Table 5.1.

5.14.2 Spatial Arrangement

Viewing from technological aspect, the multimedia classroom mainly supports the instructive classroom teaching. Therefore, the "seeding" and "U-layout" classroom spatial arrangements as shown in Fig. 5.14 are commonly used. It has no definite limitation to the number of attendance, and sufficient multi-screen display as per the scale of the classroom, and can contain hundreds of people.

Table 5.1 The list of devices allocated for new generation of multimedia classroom

Devices	Traditional multimedia classroom	New generation of multimedia classroom
Projector + screen	✓	✓
Computer used for teaching purpose	✓	✓
Multimedia console table	✓	✓
High-speed wireless network		✓
Omnidirectional tracking high-definition camera		○
Multiple display screens		✓
Cloud service platform		✓
Intelligent censor		○
Open-source teaching platform		✓
Chairs that can be moved and assembled easily		✓
Interactive feedback device		○
Tablet PC used for teaching purpose		✓
Virtual simulation device		○

○ represents for optional device; ✓ represents necessary devices

Fig. 5.14 "Seeding" and "Multi-U-layout" multimedia classroom spatial arrangement

5.14.3 Teaching Application

The smart multimedia classroom environment is usually equipped with devices such as multi-screen display, interactive feedback equipment, tablet computer for teachers and virtual simulation equipment, which allows effectively integration of information technology, digital resource and classroom teaching. The featured teaching case in the classroom environment is shown as Table 5.2.

Table 5.2 Example of teaching application in smart multimedia classroom environment

Index	Teaching integration	Remarks
Resource access	Timely and convenient transmission	In virtue of high speed wireless network, teacher can acquire resources in a timely way
Content presentation	Multi-screen presentation	(1) Different formats of the same resource, for example, one screen for text and the other screen for animation (2) The 2nd piece of slide is automatically shown on the other screen when displaying the 2nd piece of slide
	"High-definition display" presentation	"High-definition display" to realize the immediate transmission of the content of tablet computer. For example, slide on the panel with fingers, and display high-definition video on the projection curtain to assistant to teaching
	3D presentation	It is available for teachers to realize the 3D presentation of image by 3D projector equipment
Learning activity	Voting	Evaluate the works and achievements of learning activity on the basis of interactive feedback equipment
	Responder	Develop teaching activity of knowledge competition on the basis of interactive feedback equipment
	Synchronous classroom	Realize special classroom by connecting with remote students by multi-screen
Learning interaction	Somatosensory learning	Conduct interaction with screen directly with body movement by utilizing somatosensory equipment
	Immediate evaluating	The students finish the online test, and the teachers can give immediate display and feedback of evaluating result

5.14.4 Typical Cases

The multimedia classrooms can effectively improve the construction of "Special Delivery Classroom", "Elite-Teacher Class" and "Elite School Network Classroom". Taking special delivery classroom as example, it can make the students in remote areas with insufficient teaching and research resources and weak teaching strength have the same class as the students of town center schools with abundant educational resources. For example, Enshi Tujia and Miao Autonomous Prefecture is situated in the poor mountainous area in southwest of Hubei Province; the rural schools are dispersed distributed in this prefecture, with relatively lagged school conditions, protruding classroom lacking problems and insufficient educational resources. Since 2010, this prefecture realizes "Village dream project", and enlarge and enrich the rural educational resources by utilizing multimedia classrooms, and form "consubstantial teaching" and "aid synchronous teaching" synchronous classrooms. The "consubstantial teaching" synchronous classroom shown

Fig. 5.15 Real picture of "Consubstantial Teaching" special delivery classroom of Erpo teaching point and Jinmao primary school

as Fig. 5.15 combines the classes of the same grade of the Erpo teaching point in mountainous area and the Jinmao Primary School, with lesson preparation, lesson giving, homework and exam at the same time.

5.15 Upgrading Computer Rooms

The computer rooms will be changed in the future. We will conduct analysis on aspects of the device allocation of traditional computer rooms and new generation of computer rooms, the available spatial arrangement, teaching application of new generation of computer rooms and typical cases.

5.15.1 Classroom Equipment

The Computer room is a type of special classroom environment. This type of "strong interactive" classroom can effectively support the acquisition of computer and simulation operation skills, which is also applicable to the research learning or project-based learning. The device configuration of computer rooms is shown as Table 5.3.

Table 5.3 Device configuration list for computer room

Device	Traditional computer room	New generation of computer room
Projector + curtain	✓	
Computer for teachers	✓	✓
Multimedia console	✓	✓
High speed wireless network		✓
Comprehensive tracking high-definition camera		○
Multi-screen		✓
Cloud service platform		✓
Intelligent sensor		○
Open source teaching platform		✓
Tables and chairs easy for movement and combination		✓
1:1 Computer for students	✓	✓
Exchange board	✓	✓
Server	✓	✓

5.15.2 Spatial Arrangement

The teaching model in a computer room environment takes the combination of demonstrative teaching and autonomous operation; the spatial arrangement is relatively single, and the "Queue" arrangement shown in Fig. 5.16 is the most commonly used. At the same time, with the occurrence of new types of teaching methods based on project-based learning and group association innovation, "Multigroup Round Table" computer room spatial arrangement is gradually becoming more popular.

Fig. 5.16 Spatial arrangement of "Queue" and "Multigroup Round Table" computer room

5.15.3 Teaching Application

The smart multimedia classroom environment is equipped with enough computers for students. Utilizing resource sharing platforms such as cloud service and online education, smart multimedia classrooms can effectively realize the in-depth integration between information technology, digital resource and classroom teaching, and the featured teaching case in the classroom environment is shown as Table 5.4.

5.15.4 Typical Cases

Classes developed by Hunan Changsha Vocational Institute of Civil Affairs focus on the practical operation and analog simulation. All the classes are developed in a computer room environment. Since September 2010, relying on the "vocational education new line" website, and using cloud computer network space as the platform in combination of high speed network computer classroom, developed the face to face teaching, and realized Connecting Students in Cyber Learning Spaces. All teachers and students of the school participate in the construction of teaching resources; teacher construction lessons as well as share teaching resources such as teaching plan and courseware in the spaces; students finish homework and collect data in spaces; teachers and students conduct interaction and communication in spaces, and share teaching and learning resources. Figure 5.17 shows that students are learning in computer rooms relying on cloud computer network space. Up until

Table 5.4 Example of teaching application in smart computer room environment

Index	Teaching integration	Remarks
Resource acquisition	Timely and convenient transmission	In virtue of high speed network, students acquire immediate resource from teacher end or the internet
	Connecting students in cyber learning spaces	Students acquire immediate resource from individual network space
Content presentation	Multi-screen presentation	Students present the works on non-main teaching screen
Learning activity	Group association learning	Group association to finish software operation, to design innovative works
	Remote group association	Develop remote online association and exploration on basis of terminal, to finish the learning tasks together
Learning interaction	Remote control	Teachers can conduct real time remote control and sharing by broadcasting
	Paperless exam	Give immediate feedback to paperless exam result, and conduct re-test aimingly

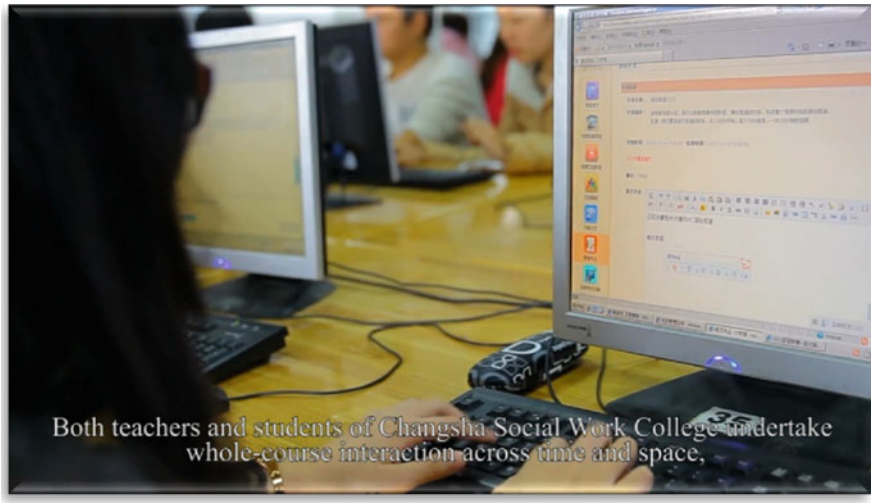

Fig. 5.17 Real picture of cloud computing network space learning in Hunan Changsha Vocational Institute of civil affairs

the end of 2014, the teaching resource has begun to take shape: more than 900 space resource lessons constitute the lesson wall, 12 network live system, 10 great master studios constructed by the school and enterprises, 3.2 million network teaching resources as well as 130 million network teaching resource page view.

5.16 Upgrading Interactive White Board Classroom

The interactive white board classrooms will be changed in the future. We will conduct analysis on aspects of the device allocation of traditional interactive white board classrooms and new generation of interactive white board classrooms, the available spatial arrangement, teaching application of new generation of interactive white board classrooms and typical cases.

5.16.1 Classroom Equipment

The interactive white board classroom has been popular in recent years. This type of "strong interactive" classrooms can well present the teaching contents in classroom teaching, and operations such as drawing and dragging can be conducted on the screen. The device configuration situation of interactive white board classrooms is shown as Table 5.5.

Table 5.5 Device configuration list for interactive white board classrooms

Device	Traditional interactive white board classroom	New generation of interactive white board classroom
Computers for teachers	✓	✓
Multimedia console	✓	✓
High speed wireless network		✓
Comprehensive tracking high-definition camera		✓
Multi-screen		✓
Cloud service platform		○
Intelligent sensor		✓
Open source teaching platform		✓
Tables and chairs easy for movement and combination		✓
Interactive feedback equipment		○
Interactive electric white board	✓	
Short focal projector	✓	
Large screen touch control liquid crystal all-in-one machine		✓
Large screen touch control interactive desktop system		✓

5.16.2 Spatial Arrangement

The interactive white board classrooms can efficaciously support classroom teaching and group association interactive learning method. Therefore, the "Seeding" spatial arrangement shown as Fig. 5.18 is commonly used. With the

Fig. 5.18 "Seeding" and "Multi Round Table" interactive white board classroom spatial arrangement

occurrence of new types of learning methods such as the group association innovation or the "Multigroup Round table" which lay stress on association is gradually popularized.

5.16.3 Teaching Application

The smart interactive white board classroom environment is equipped with large screen, touchable large-sized screen interactive desktop system, and tablet computer for teachers. It can effectively realize the in-depth integration of information technology, digital resource and classroom teaching. A teaching example of the classroom environment is shown as Table 5.6.

5.16.4 Typical Cases

The interactive electric white boards are popularized in the 42 teaching classes of Beijing Dengshikou Primary School, as shown in Fig. 5.19. Based on the

Table 5.6 Example of teaching application of smart interactive white board classroom environment

Index	Teaching integration	Remarks
Resource acquisition	Timely and convenient transmission	The group acquires resource from internet or teacher terminal based on interaction desktop system
	Convenient resource sharing	Real time sharing works between groups
Content presentation	"High-definition" presentation	Realize the presentation of group interaction desktop system in tablet computer for teachers
	Virtual simulation	Finish the experiments which are risky or with high cost in traditional experiment environment
Learning activity	Group association	The activity based on large desktop display screen, for example, association creation and association correction
	Synchronous classroom	Connect with remote students by multi-screen, to develop association learning
Learning interaction	Learning tracking	Record the teaching activity and test result during the interaction between students and equipment, and give evaluation report
	Content mark	Students give signs on key and difficult points as well as review to video resource based on after class review feedback equipment
	Interactive demonstration	Teachers develop interactive demonstration based on the touch control all-in-one machine, for example dragging, zoom and drawing

Fig. 5.19 Real picture of classroom teaching in future classroom of experimental primary school in Suzhou District Suzhou City

interactive teaching using the white board, it can change the thinking methods of students and improve their learning quality. By utilizing interactive white boards, and based on teaching subjects, teachers can make gradient design, and can write on the white board, and control computer programs to realize the effective synchronization of computer, projector and interactive white board. Teachers demonstrate any content in the computer for audience by the projector, and operate the computer by the interactive white board, without being in need of returning back to the computer. The white board is integrated in the daily classroom teaching, to make teachers more passionate and provide more interaction between students and teachers, as well as to make students have more autonomous learning.

This type of classroom mainly serves for expanding teaching tasks of Chinese, Mathematics and English, once a month for each class on average. The "one-person-one-machine" teaching environment in Future Classroom realizes the autonomous inquiry learning which takes "learning" as the principal thing, for example: on the Chinese composition class "Wonderful 3D Printing Technology", teachers make students have sufficient interaction, and conduct independent inquiry of 3D printing technology. During the teaching process, students can obtain more visual feelings by watching video 3D printing effect. According to the investigation, more than 90% teachers who have used future classroom express sufficient confirmation on the role in interactive, discussion and inquiry teaching.

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