1. Advancing Cultures of Change and Innovation

New Schemes for the University Entrance Examination
Ministry of Education of the People's Republic of China

The university entrance exam is short for the National Ordinary Higher Education Entrance Examination, which determines the selection of new students by Chinese institutions of higher learning (excluding Hong Kong, Macao, and Taiwan). The original intention of the university entrance examination system was to allow everyone his or her equal right to education. This system supports talent selection, yet, at the same time, restricts the implementation of quality education and the dissemination of educational information. In recent years, China’s Ministry of Education has put forward a series of reforms to change the existing test evaluation and recruitment system, aiming to improve comprehensive talent evaluation and promote the process of national education development.

In terms of reforming the examination evaluation system, there are two areas of improvement: the first is the senior high school academic proficiency test and comprehensive quality assessment, which helps students succeed in their courses and then select others according to their own interests, allowing them to develop their specialty. This also helps guide students to participate in public service and social practice, etc.

The second is to comprehensively transform the high school academic proficiency test; the reforms aim to reduce the number of subjects tested on the exam and to measure learning regardless of arts and sciences. This change will also allow students to have more than one chance per year to pass the exam for their foreign language course, which will increase the students’ choices. These reforms will also help eliminate the disadvantages of its extreme nature, reduce the intense pressure of the test, and promote the healthy growth of millions of students while strengthening the scientific talent selection system for all kinds of colleges and universities, thereby promoting social justice.

Currently, university entrance examinations measure two kinds of talents, and it does this in two ways. The first way is through the current university entrance exam, which measures academic talents; the second mode is an examination for technical skills. The university entrance examination is designed to test for both academic and technological knowledge and talent. There are three kinds of technologist profiles: engineer, senior technician, and high-quality workforce. Technological skills are cultivated through the application of educational technology and strategies such as 3D printing and makerspaces, which emphasize the ability to create.

Furthermore, reforming the entrance examination will emphasize measurement of comprehensive learning, reduce students' test stress, resolve conflicts between the traditional examination system and application of knowledge, allow students to choose courses according to their interests, and generate more time and space to use educational technology.

The university entrance examination reforms aim to change the national talent cultivation and training mechanism from the traditional examination to a system that takes into account the overall quality of a student's talent. This will promote the process of China's educational development, which needs to be planned, tested in advance, implemented step-by-step, and advanced over the long-term.
2. Shift to Deep Learning Approaches

Teacher and Student Joint Reading Activity Based on the Learning Cell Platform

_Huashan Middle School, Korla_

The teacher and student joint reading activity carried out by Grade Three of Huashan Middle School (Primary School Section) of the 2nd Infantry Division of Xinjiang production and Construction Corps is based on the Learning Cell platform. It is made up of four processes, which include mutual initial reading, personalized intensive reading, group study, and reflective rereading. This activity encourages students to read and study the classics in pairs.

The school leverages the Learning Cell platform to create and develop a learning community, to organize the joint reading activity in the form of discussion groups, and to help students explore extended reading materials through Learning Cell. The platform also allows students to record their ideas regarding their understanding of the reading.

The initial reading stage begins with a guided reading lesson, which stimulates students' interest in the reading. The students then use a tablet PC to engage in free reading after the guided reading lesson, and then post their own questions, comments, and ideas on Learning Cell during the reading process. Meanwhile, teachers send a digital recording of the reading to students in order to diversify their methods of comprehension. Experimental teachers will propose questions based on the contents of every chapter, which helps them understand their students' progress through their replies.

During the personalized intensive reading stage, the teacher explains the task at-hand and then has the students read the part they are most interested in. The students then record their perceptions of the reading on the Learning Cell platform. Furthermore, the learners are able to make modifications of their notes from the initial reading. Students can try to answer questions that came up in the initial reading by rereading the texts.

After completing these tasks, students review their notes on Learning Cell, reconsider their own comprehension, and make corresponding modifications of them. Alternatively, the students can also evaluate each other's notes and answer other student's questions. Then teachers review the students' notes and select special topics for discussion based on the contents of the text, offering the corresponding scaffolding strategy for instruction.

During the group study stage, students choose their research topics of interest and then select teammates that are interested in the same topics to form a group. Each group has 4 to 6 students in addition to a group leader who is selected to lead the research process. The joint reading activity at this time is divided into six groups, two groups for each topic. After creating teams, group members read the books freely according to the form provided by the teacher, and they complete the task independently. Afterwards, the group leader organizes the group members to discuss the question in order to come to a consensus about its answer. Once this task is complete, the group's results are published on Learning Cell to be reviewed and commented upon by the other teams.

The last stage of the teacher and student joint reading activity is reflective rereading, which emphasizes the students' gains during reading. This format includes multiple choice questions, presentation of student work, online communication between classes, and reflective thinking and note taking during reading. Students complete the task in the Learning Cell platform independently, further promoting the deep reading learning process.
3. Redesigning Learning Spaces

The Reconstruction Project of the Science and Technology Museum of Shijia Primary School
Shijia Primary School, Beijing

Shijia Primary School has designed its popular science content and technology projects around the theme of the space station, abiding by the STSE (Science, Technology, Society, Environment) educational idea. This forms the basis of the Shijia Primary School scientific literacy action curriculum (Shijia No. 5). Shijia Primary School Science and Technology Museum is designed into different segments that reconfigure the learning space a variety of ways.

Modern equipment is integrated throughout the scientific exploration area where many types of teaching activities and student experience programs take place. The curriculum also integrates a number of multi-disciplinary issues on topics including the physical sciences, life sciences, earth sciences, engineering sciences, physics, chemistry, geography, materials, environment, technology, life, psychology, and other disciplines. These modern technology experience zones fulfill the needs of teachers and students, strongly supporting classroom teaching, students’ inquiry, and after-school programming, in addition to other activities in the schoolyard.

The aim for Shijia No. 5 was to become a “dream making space” with the “space station” as the overall framework for the design in addition to the capsule interaction zone, subject laboratory, digital planetarium, digital science and technology museum, earth and space exhibition hall, greenhouse, and other themed areas. A large number of exploratory projects are based on the educational layout of STSE and reflect the harmonious curriculum of Shijia Primary School.

Because the teaching space has a clear theme, rich content, and a combination of hard equipment and soft resources, the learning that takes place promotes the holistic development of man and technology. Every student can understand the relationship between science and technology and social development through independent research, teamwork, teachers' guidance, and other diverse learning styles. As a result, students are constantly improving their comprehension of their social responsibility, strengthening the relationship between today's knowledge and tomorrow's development.

4. Increasing the Use of Blended Learning Designs

"J Class" Micro-Video Learning Platform
Education Bureau of Putuo District, Shanghai

The "J Class" micro-video learning platform was jointly developed by the Huashi Education Cloud Institute and Education Bureau of Putuo District in Shanghai. It is a comprehensive platform that integrates learning resources, learning process records, learning evaluations, intelligent feedback, and personal space, providing a comparatively comprehensive hybrid learning environment for teachers, students, and parents. "J Class" facilitates data-driven teaching exploration and research and provides students with a personalized learning experience, making the transformation their learning styles possible through the creation of learning process records, learning evaluations, intelligent feedback and other features.

Micro-video is used for the preview stage in the classroom, which makes students’ first impression of a topic more concrete. Three application modes of micro-video are formed in the process of the practice:

1. The "preview-reversal style" teaching mode: before class, students complete autonomous learning through watching micro-videos and doing homework in order to achieve their initial learning; in class, the teacher designs corresponding learning activities according to the student’s
prior study, consolidating the new knowledge in order to cultivate the students’ higher order thinking ability.

This method also promotes the transformation of the teaching and learning styles, overcoming the limitation of the traditional classroom in order to create a flipped classroom teaching model of “teaching after learning, teaching based on learning.”

(2) “Classroom-assisted” teaching mode: micro-video used in the whole learning process including before class, during class, and after class, to aid teaching. For basic knowledge points, the students are required to watch the corresponding micro-videos on the "J Class" platform and complete the preview assignments and notes. For the key points and difficulties, the students are organized into groups in class in order to carry out cooperative learning using the micro-video. For the problem areas, the students are organized to conduct inquiry-based learning after class.

(3) The “individual-tutoring” teaching mode focuses on students’ individualized learning and personal development, providing each student with the learning environment and resources to achieve autonomous learning.

For the students’ questions and problem areas during the learning process, the platform offers corresponding coaching by selecting the appropriate micro-videos, meets the students’ learning needs through a “teachers are always by my side” approach, and solves the students’ learning difficulties anytime and anywhere. By studying inquiry-based micro-videos, students can extend the subject content individually to promote their own innovative ideology and practical ability.

In recent years, Putuo District improved the micro-video from the technical level to the design level through the exploration of the “J Class” project. The data requirements of making micro-videos have also become more inclusive, beginning with dimensions of original knowledge and skills, expanding to dimensions of process and gradual method, and will be further enhanced to include dimensions of emotional attitude and values. Teachers and students’ participation in “J Class” has also been supported through their constructions of another learning platform; teachers and students jointly built Learning Fairyland to achieve three functions including the sharing of resource construction, data recording and analysis, and collaborative innovation between teachers.

Regarding these new teaching models, both teaching after learning and autonomous learning options are explored; regarding the technical progress of the project, both top-level design and grass-roots innovation have been considered, allowing all education practitioners working on the frontline to share their experiences and knowledge.

**Smart Schools**

*Beijing Wangjing Experimental School, Beijing*

Through the construction of the smart classroom and cooperative learning by TBL group, Beijing Wangjing’s Experiment, The School, applies technology and innovative learning methods in K-12 classrooms to promote the overall construction of the Smart Schools model.

The digital smart classroom is built on the TEAM Model, which provides various information and communication (ICT) equipment according to the teacher's teaching needs, achieving a combination of convenience, intelligence, and efficiency through ICT smart teaching aids. In this teaching environment, electronic products such as an electronic whiteboard, responder, and a material object display stand, allow students to resolve problems using remote controls, giving every learner a chance to take an active role in class and increasing their enthusiasm about the learning activities. These tools increase student engagement because they can interact with the large screen using their small remote controls, which is more active than having them read books.
The abovementioned teaching methods not only augment student participation, but also enhance the class as a whole, creating the conditions for students to gradually improve their performance on subsequent assessment and diagnostic systems.

The smart classroom system supports the cooperative teaching process in which everyone is involved, thinking actively, engaged in collaborative discussions and group training, and sharing the rewards of accomplishing the learning task.

This system also integrates information technology and effective teaching methods, solving the problems that have perplexed teachers for many years; it enables students to actively participate in the learning processes, measures performance, provides feedback analyses, supports interactive teaching, and provides a way to assign individualized homework tasks. It helps teachers track evaluations throughout the entire learning process and establishes the diversified, personalized learning environment that greatly stimulates students' potential based on their unique level of development.

5. Proliferation of Open Educational Resources

National Public Service Platform For Educational Resources
Ministry of Education of the People’s Republic of China

The Ministry of Education of China held the opening ceremony for the “National Public Service Platform for Educational Resources” in Beijing on December 28, 2012. From then on, the National Public Service Platform for Educational Resources has been in beta operation, comprehensively promoting the sharing of digital educational resources. The National Public Service Platform for Educational Resources is part of the Outline of the National Medium and Long-term Education Reforms and Development Program (2010-2020).

This platform takes full advantage of cloud computing technology to gradually promote the interconnection of regional educational resource platforms and service platforms. It serves all education sectors including pre-school education, compulsory education, senior high school, vocational education, and higher education. This program has also built a network to share application environments for resource providers and users.

The National Public Service Platform for Educational Resources emphasizes resource push services focused on the learning space, sending the appropriate resources needed by different users through a service that allows teachers to upload and download resources. It also provides a way for students, parents, and schools to connect with the teacher's teaching space, promoting "class access to high quality resources" and "equal access to learning spaces on the network.” The National Public Service Platform for Educational Resources has two characteristics: first, it supports healthy and sustainable development of the platform with high-quality resources as the core; second, the students, parents, and institutions can make full use of the space under the leadership of the teachers.

The initiative will also build the new system for educational resources and applications "with the public service platform as the guidance, school application as the main part, and the social joint development and sharing as the support” in China. As a result, these high-quality resources and innovative applications will benefit everyone.
6. Improving Digital Literacy

e-Learning in the Smart Classroom Environment

Xiangbin Primary School, Harbin

In November of 2012, Harbin Xiangbin Primary School was approved to be one of the pilot schools designed to facilitate the innovative exploration of teaching using information technology by the Ministry of Education. The school carried out its research focusing on the development of student ability, the renovation of the learning environment, and the adoption of the innovation model.

Harbin Xiangbin Primary School built the "smart classroom" based on the concept of a student-centered classroom through the use of advanced mobile Internet and rich media technology. These resources helped teachers engage in practical and highly effective teaching practices, which encouraged students to become more engaged through the use of interesting rich media resources. Further, the “smart classroom” has enhanced interaction through the gamification and socialization of the teaching mechanism. As a result, teachers are able to monitor and communicate effectively with students and collect the data about their classes and learning process.

In terms of hardware construction, the school built a diverse teaching environment that includes an electronic whiteboard, a network classroom environment with a desktop computer, and a notebook PC and tablet environment with a mobile learning terminal. This resource-rich environment meets the requirements of e-lesson preparation, courseware production, and individualized learning.

In terms of software construction, the school developed a school-based library, project library, and wide-area library that allows students to carry out autonomous learning, presentation preparation, practice examinations, and interactive communication in class, after class, and after school. With this new functionality, teachers can deliver effective teaching strategies using this hardware and software. These high quality resources also encourage teachers to widen their horizons and embark on new innovative teaching ideas.

In the "smart classroom," the teacher's platform is no longer just a blackboard, but a multimedia platform that includes an interactive whiteboard, an interactive tablet PC, an intelligent cloud box, and an intelligent robot teacher. Each student has an electronic schoolbag. The interactive tablet PC can be easily moved, and it is a convenient way for teachers to record information, making it easier for them to understand their students’ progress and the effectiveness of their teaching methods at any moment. The “smart classroom” makes it possible for everyone student to learn everywhere. In class, every student holds a tablet PC that stores readings, new words, exercises, and assignments. Every student has a student number; their preemptive answer is also displayed on the small screen.

When using their tablet PC, the teacher can touch the screen to engage the electronic whiteboard or play music or video information, which enhances the interaction between the teacher and students making the learning experience more fun. The innovative features of the “smart classroom” make learning a more light-hearted and friendly experience, which has transformed Xiangbin Primary School. The “smart classroom” has changed teachers’ way of organizing the classroom, comprehensively improving the digital literacy of teachers and students, thereby encouraging student cooperation and independent inquiry.
7. Integrating Technology in Teacher Education

**Teacher Network Learning Space to Promote Innovative Methods of Education and Teaching**  
*Education Bureau of Gongshu District, Hangzhou*

This new model of teacher’s professional development establishes and expands high-quality educational resources based on the concept of “Internet + education.” The new model integrates regional research and training, school-based research and training, personal research, and network studio, overcoming interscholastic, inter-discipline and regional barriers, and breaking through the boundaries of time and space in order to enhance teacher’s professional development.

The network learning space consists of two forms. The first is the establishment of the individual research process, which includes the stages of self-planning, independent study, mutual communication, presentation and sharing, and research evaluation.

It mainly includes: (1) the research mode of “sharing and communication in the teachers’ circle.” Findings and problems will be published and recommended in the teachers’ circle, forming the sharing-communication study mode that includes “liking” contributions, adding comments, and replying to the findings and problems posted within the circle; (2) the “self-reflection of classroom teaching” research mode, wherein the teacher initiates their personal research activities by analyzing and reconsidering classroom notes, courseware, teaching plans, and teaching behaviors in order to detect successes and failures during their teaching process with the goal of enhancing their teaching ability; and (3) the “data analysis incentive” evaluation model, which uses the activity data of the teachers in the network learning space (studios) as encouragement to advance in their research activity.

The second mode is based on group research. With network studio as the basis, teachers can contribute different thoughts, ideas, teaching models, and teaching methods that produce communication and resolve conflicts within the classroom. This collection of wisdom inspires teachers to engage in democratic and open-ended group research across time and space for mutual growth.

It mainly includes: (1) The “peak research” teacher-leading mode, which is led by a special-class teacher who not only collects high-quality resources regarding special programs, but special topic discussions and high-end conversations reflecting the special-class teachers' thoughts and ideas on education. This is an important method of cultivating high-quality teachers within the area.   
(2) The research mode of “resource sharing” in district and school involves studying key content and spaces for teacher professional development and carrying out training activities in districts and schools by organizing them in advance, in real time, and for subsequent exchange.   
(3) The method of constructing a localized resource system that is driven by research. This information is crucial for teachers to deeply understand and reflect on the discipline and others' experience of it.

This project is implemented mainly through the following three ways; the first is multi-sector promotion. The teacher's career development is facilitated by the District Education Bureau, technically supported by the Technical Center, and practically led by the Teaching and Research Center. The second method of implementation combines regional, school-based, and individual research, which are blended in the network learning space, forming the network learning community. The third is the integration of online and offline intercommunication study in the special-class teacher studio.
Currently, the teacher network learning space of Gongshu District has more than 150 studios and more than 3,000 learning spaces, engaging more than 1,500 teachers in research activities throughout Gongshu District. The online learning space widens the channel for research and training, improves teachers’ understanding of the discipline, expands space and time for research activities, and allows for the diversification of teachers’ training methods.

The network learning space also enriches research and training content, ensures that teachers’ meet their personalized specialty requirements, and provides a place to accumulate curriculum resources. The teacher network learning space is changing how research and professional development is done among teachers in the Gongshu District, promoting the innovation of education and teaching models for teacher’s individualized growth. It has since become the engine of educational development in the Gongshu District.

**Intel® Future Education Program**
*Intel Corporation*

The Intel® Future Education Program was launched in 1999, and has trained more than 15 million teachers in seventy countries and regions worldwide, benefiting more than 300 million students globally. It has become one of the largest and the most successful projects of its kind. The project fully embodies and perpetuates the idea of modern education, guiding teachers to use educational technology for teaching and promoting the transformation of their professional development and teaching strategies. As a result, students benefit from the change in learning methods and are able to gain the key competencies and skills necessary to adapt to the social environment of the 21st century.

The Intel® Future Education Program was launched officially in China in July 2000, and was strongly supported and fully affirmed by the Ministry of Education of China as well as local government. The program introduced innovative teaching ideas, training modules, and management processes for domestic teacher training, which helps pre-service and in-service school teachers learn how to incorporate information technology and resources in their teaching and carry out "student-centered" activities. It has played an important role in improving teaching quality and teachers' professional development.

In addition, the program was formally incorporated into a country-wide promotional project that showcased school teachers who played a leading role in advancing innovative teaching strategies and content at the end of 2013. In 2014, the Intel® Future Education Program trained more than 90,000 primary and secondary school teachers in the country, and a cumulative total of more than 2.29 million from around the world, benefitting hundreds of millions of students. It has become the largest international cooperation project of teacher training carried out in China.

**The Micro Course’s Application in Teaching Research with Network**
*Education Bureau of Xinji, Xinji*

This teaching and research project was carried out using information technology in Xinji City of Hebei Province. The teachers produce a training plan based on the flipped classroom, record the micro course in advance, and upload them to public platforms such as Tower. Then, they release the information using IT methods such as a QQ group or WeChat public number with a reminder for teachers to install the software in order to carry out the discussion on YY (a mobile interactive application for smartphones) while watching micro courses at the appointed time.

Offline, the teachers determine the research subject, record the micro course for the teaching scene, and upload it for sharing; online, the teachers watch the micro courses and make comments.
on them, using YY to record the screen to complete the research record. The specific research process is as follows:

Offline Component:
(1) Determine the subject to be explored during on-line teaching and research; determine a certain school to have a field class; record the micro course; and, upload to Tower for sharing in advance.

(2) The teacher on-site provides initial information about class and provides an observation task.

(3) After the observation, all of the teachers evaluate each other. After the key teachers review and give comments, the classroom teachers complete a reflection.

(4) After determining the subjects of the online teaching and research, tasks are assigned; the key teachers complete and share the records of the teaching and research.

Online Component:
(1) Determine the theme and record micro courses. The school then determines the subjects of the experimental teaching and records the micro course after preparing the individual and collective lessons. The micro course essentially explains how to introduce the experimental lesson, how to conduct the experimental exploration, how to effectively apply innovation in the classroom, and then finally evaluate the outcomes of the experiment.

(2) The micro courses will be uploaded onto the Tower platform ahead of the class so that they can be watched by teachers and commented upon. A key teacher will be specified in advance to review the comments.

(3) Organize the front line teachers who will be involved in the live broadcast on YY channel at the appointed time, which will be chaired by the various districts in turn. The basic process: the host explains the research topic; they play the micro course fragments; the front line teachers comment; the key teachers’ review and comment; the teachers complete their reflections.

(4) The host will summarize the teaching and research achievements of the given theme, and the research records will be completed and shared. During this research process, information technology is used to manage and facilitate real-time review of research in order to maximize the effects of pedagogical study.

8. Creating Authentic Learning Opportunities

English Teaching Based on the Technological Environment

Beijing Shidade Education Technology Co., LTD, Beijing

This project of the Education Equipment Research and Development Center of the Ministry of Education is being developed in schools throughout the country through work groups organized by Beijing Shidade Education Technology Co., LTD. The project delivers adaptive multimedia courses as supplementary courses for English language courses at school, allowing students to acquire adequate language training and overcome their learning obstacles. The adaptive platform facilitates personalized English learning in class supported by the network, multimedia, and speech recognition technology, in addition to a wide range of vivid and purposeful human-computer interactive exercises. Meanwhile, the learning management system attached to the courses helps teachers, students, and parents understand students’ learning situation and learning processes anytime and anywhere.
The multimedia courses adopt a diversified learning style that integrates "multimedia class learning," "face-to-face instruction," and "home study." In the multimedia class, each student has a computer and learns under the guidance of teachers in the form of human-computer dialogue. Effective listening and speaking is encouraged through situations that require dialogue; the software helps students accurately pronounce English words using speech recognition technology in addition to providing ample exercise opportunities. The learning courses are completely customized to improve self-directed learning while cultivating students’ interests in learning through the formative assessment system, which helps them develop healthy study habits. In face-to-face teaching, students experience class instruction, participating in a variety of games and activities, and reading and writing practice. This part of the course encourages students to communicate with each other, to make presentation, and to cooperate in groups while cultivating the students' reading and writing skills.

The home study style allows students to replicate the face-to-face learning process using multimedia equipment, while at the same time reviewing, previewing, or completing the homework assigned by the teacher. In this way, parents can fully grasp the child's learning process and educational materials while cooperating with teachers in order to provide the corresponding tutoring. Please note that the learning modes listed above cannot meet the students’ learning needs on their own. This program provides instruction to students through a diversity of learning styles and real English dialogue situations, which enrich students' understanding of the English language.

9. Cloud Computing

Education Cloud
National Public Service Platform For Educational Resources

Education Cloud is the migration of cloud computing into the educational environment. This technology allows stakeholders in the education sector including schools, teachers, students, parents, and others to enter the platform and take on different roles, combining tools that facilitate teaching, management, learning, entertainment, and communication via a unified and diverse platform, which is aimed at "achieving the real digitalization of education."

Cloud storage is the most widely used domestic education cloud service, which can store its own data in the safe storage server using the network. This allows users to connect to the storage server by using their personal device wherever they are. Cloud storage does not require the users to have profound knowledge of the network; users only need to have an account and a network device in order to meet their network backup needs and share with others. In education and teaching activities, cloud storage is pushing learners into a new era of learning.

The remote education cloud can be a resource center with a teacher forum assembly, a student assembly, and chat tools. Currently, a number of Education Cloud platforms have developed domestically, such as the Bao'an District educational digitalization integrated application cloud service platform, which is the country's first cloud platform for K-12 education; the National Public Service Platform for Educational Resources, which provides free access to all levels of national education to the public; and, the "Guangdong Teaching Cloud," an independent, controllable, safe, and sustainable cloud computing service platform for K-12 education that serves many provinces within China.

Education Cloud contains educational resources that have been networked, virtualized, and connected to one or more servers, which can then be leased to schools and students. Schools within the same district can implement secondary development according to their own characteristics and avoid repeated input. Resource sharing as well as interaction can happened.
between schools, promoting a regional balance for educational development. From the teachers' standpoint, resources can be obtained from the cloud and added to the cloud at the same time; from the learner's perspective, the cloud provides learning resources as well as a virtual space to form study groups and communicate with the teachers.

With the expansion of more open educational resources, Education Cloud resources will be more widely used in all levels of education because of its increased accessibility and rich resources. The Education Cloud offers users multimedia documents, including numerical data, text files, AV (audio/video), and programs, which they can download to a local computer via the network. Currently, the domestic Education Cloud industry is still in its initial stage, but it is predicted that it will continue to push forward the development of the education industry.

10. Flipped Classroom

**Flipped Classroom Practice Based on the Tablet PC**

*No.1 Middle School of Changle Shandong, Changle*

Since 2013, Changle No.1 Middle School of Shandong Province has been using the flipped classroom teaching model designed on the basis of “learning, discussion, guidance, and practice.” The school selected two classes in the first-year junior high school and the first-year senior high school respectively to implement the flipped classroom experiment and develop the “Sunshine Micro Course” platform, a collaboration with Shandong Publishing Group Co., LTD., which provides technical support for the implementation of the flipped classroom. Students use tablet PCs to watch and participate in the micro course.

The micro course is the most important component of flipped classroom. Using micro courses in the flipped classroom is not like using traditional video clips, but rather, micro courses are an extractive presentation of a certain knowledge point. The time usually is restricted to 5 to 8 minutes, so there is high demand for the appropriateness and scientific accuracy of these explanations.

First, the school organizes a group of teacher leaders, compiles the learning plan of every grade, and then aggregates resources in accordance with the procedure for “researching the model of the learning plan, compiling the contents of the learning plan, compiling the first draft of the learning plan, and intensively modifying the learning plan.” The participating class is required to adopt the “preview + classroom” teaching model in order to be fully prepared for implementing the flipped classroom.

At the same time, teachers of the experimental classes are trained using case studies of the “flipped classroom” that were composed during the school military training period in addition to engaging in discussion through a blog and QQ group. Through self-reflection and student cooperation, the teachers are able to fully comprehend the meaning and practices of the flipped classroom. Second, after a week of independent implementation, the teachers begin attending a “weekly study class of the flipped classroom,” which requires teachers of various disciplines to give classes in turn, and all of the other teachers in the experimental class review and discuss their teaching methods immediately after class. This gradually forms the flipped classroom teaching model based on the “two parts, four steps, ten links flipped classroom” teaching method.

"Two parts" refers to the two lesson types of "self-study in class" and "training and demonstration lesson." "Four steps" refers to the four steps during the teachers' lesson preparation: integration of the schoolbook, level of difficulty selection, instructional design, and micro course recording. "Ten links" refers to the ten links of student learning in the classroom, of which self-study in class makes up five, including object guiding instruction, self-study, micro course assistance, cooperative
learning, and online testing. The training and demonstration lesson includes the five links of object-guiding instruction, level of difficulty breakthrough, training demonstration, cooperative promotion, and evaluation and advice."

In the classroom, a “hybrid” learning approach is adopted. The students watch the micro video online in order to facilitate autonomous learning in which students learn at their own pace with the help of the micro courses recorded by the teacher. Micro courses can be fast forwarded, paused, rewound, and repeated, helping students to overcome the limitations of teacher-led learning and experience the fun of learning step-by-step. Offline, students conduct independent inquiry or group collaborative inquiry around the questions in the assignment, experiment, or special topic put forward by the teacher under the teacher's guidance.

**Junior High School Math Flipped Classroom Practice Using the Learning Cell Platform**

*Xianghe Middle School, Yantai*

Xianghe Middle School is a public junior middle school in Chefoo District of Yantai City in Shandong Province. Dr. Xuefeng Wei of Ludong University and the teacher Yongbo Liu of Xianghe Middle School carried out the flipped classroom model in a first-year math class of a junior high school. Researchers and front-line teachers analyzed the characteristics of the students and designed and produced the modular learning resources for topics such as “rational numbers and their computing,” “integral expression and their addition and subtraction,” “linear equations with one unknown,” “parallels and intersections,” “collection and arrangement of data,” and "generalization and practice.” This resource bundle includes micro courseware, micro videos, synchronous tests, extensive learning materials, and more.

Students use the Learning Cell platform developed by Mobile Learning Ministry of Education, a China Mobile joint laboratory that created the software. At home, students can use a computer or mobile device (iPad, smartphone, etc.) to directly log in on Learning Cell in order to access their learning materials. In order to guarantee the effectiveness of the students' study at home, the teacher also invites parents to participate in teaching activities through a QQ group.

Flipped classroom teaching provides the students with a different learning style from traditional classroom instruction, overcoming the restrictions of the teacher-led lecture in order to meet students’ needs for individualized learning. Practice shows that the flipped classroom model has helped students at the intermediate level improve their performance in mathematics.

### 11. Makerspaces

**Wenzhou Middle School Establishes a Makerspace**

*Zhejiang Wenzhou High School, Wenzhou*

The Drive the Future (DF) Makerspace of Wenzhou Middle School was established in 2008 as an open laboratory that functions as a workshop and studio. The space is not used for daily classes, but is open to all students in their spare time. Instructors encourage students of different grades and different classes to observe life, determine questions, and embark on projects that improve their technology ability and interdisciplinary skills.

Arduino is the main implementation platform for the Hacker curriculum. A diverse array of hardware platforms such as Raspberry Pi, Banana Pi, and pcDuino are used for the students' project research, development and creation, and demonstration by the teacher; the processing tools such as the miniature laser engraving machine, badge making machine, and 3D printer allow the students to connect the electronic world with the physical world; meanwhile, finished
products, eBooks, and design books provide the students with the resources they need for self-directed study.

The fixed instructors of the Makerspace are information technology teachers and general technology teachers of the technology group at Wenzhou Middle School; floating instructors include graduate students from the University of Educational Information and Engineering Institute, as well as graduate students majoring in scientific education with internship experience from a science and technology museum. The leading domestic makerspace companies that provide the operating open source hardware will occasionally send specialized makers to give lectures and lead workshops at the school. Students that have graduated as makers and parents who are proficient in electronic electric welding are also occasionally invited as guest instructors.

In order to integrate the Makerspace and provide effective interdisciplinary learning support to students, the school has established a range of STEM courses. Designed on the basis of teachers’ skills, the STEM course construction is divided into three tracks including control, interaction, and design. The control courses are: "Follow Me App Inventor,” “Arduino Creative Robot,” and “Electronic Control Technology Based on the Arduino;” Interactive courses include: “S4A Interactive Media Technology” and "Internet of Things and Big Data.” The design class mainly contains "3D Model under the Mathematics Horizon” and “3D Printing and SketchUp.”

The curricula for these courses are focused on design, control, and interaction, and the courses are carried out as elective courses, which account for 18 hours of classes. They are accessible by all of the students at the school. Although these courses are not carried out in the Makerspace, this is where the tools and equipment required by the courses can be found. The role of Makerspace is to be the students' training base outside of the elective courses.

12. Mobile Learning

Innovative Education Based on a 1:1 Digital Mobile Learning Environment
Shanghai Luochuan School, Shanghai

Shanghai Luochuan School has created a 1:1 digital mobile learning environment with the CMPC (Classmate PC) provided by the Intel Corporation with the goal of conducting a practical study about cultivating students' innovative thinking ability. The school has designed the innovative education project based on the theme of "e-Driven Lights Life, Intelligent e-Growing Together," a concept that aims to create highly interactive and personalized smart learning environments using the Intel student notebook, which supports effective teaching practices and cultivates students' competency in the 21st century.

This project has completed the planning, project implementation, teaching implementation, and promotion summary stages. During the project planning stage, every teacher took the "Intel Future Education" course in order to grasp the practical skills of the notebook PC and the Web 2.0 applications. They also built an "Intelligent e-Home" class network framework and completed the input of basic data. In the project implementation stage, the teachers constructed the curriculum, carefully preparing the experimental cases in order to provide the practice model for implementation in the new semester. The school assigned the students household and community activities during the summer vacation time to be completed in the "Intelligent e-Home."

During the teaching implementation stage, the school carried out the 1:1 mobile network learning project practice and completed the teaching case studies. At this time, teachers attended lectures to conduct mutual evaluations, discuss the case studies, and share their experiences on a regular basis. The schools had teachers, students, and parents participate in questionnaires, interviews,
and brainstorming activities as part of a collective problem-solving approach; meanwhile, they have engaged expert consultants to guide the work in the school. Comparisons have been made between evaluating learning indicators and research data, and the findings have been disseminated in group discussions.

During the promotion and summary stage, the school compiled a comprehensive collection and classification of the data in addition to soliciting opinions from experts, peers, and teaching and administrative staff on the "Project Report" and other materials.

The 1:1 digital mobile learning environment of Luochuan School facilitates students’ personalized learning style, which is student-centered, emphasizes the cultivation of the students’ ability and the development of their personality. This model supports teachers as they construct their teaching practice on digital resources and transforms their curriculum into an “ability-based” course system, which comprehensively improves students' skills in the 21st century.

13. 3D Printing

**3D Modeling Course In Close Connection with Mathematics**  
*Zhejiang Wenzhou High School, Wenzhou*

The 3D printing course at Zhejiang Wenzhou High School is for first-year senior high school students, which pays equal attention to theory and practice. Based on 3D modeling knowledge, this course is an introduction to the creation of 3D models with 3D software (OpenSCAD), wherein students learn to describe the spatial relation between objects through the creation of 3D models using mathematical functions, mathematical operational signs, and computer languages.

This course also encourages students to interpret and analyze the formational and structural features of 3D models using related mathematical concepts, improving their overall ability to deal with problems while cultivating their innovation ideology and ability. It also focuses on training students to grasp the common SCAD language, and using auxiliary tools, helps students gain the ability to draw moderately complex 3D models in order to understand the general process of producing 3D models with mathematical thinking.

Additionally, students learn to master several common function models and to apply the model to simple situations, which improves their basic abilities of inference and argumentation, operation and derivation, data processing, linguistic organization, and language performance. Moreover, this course improves the students’ mathematical ability of raising, analyzing, and solving problems. The students’ ability to recognize and apply mathematical concepts and innovation consciousness are developed as they think about mathematical models contained in the real world.

The course can be divided into seven special topics including "First Knowing 3D Printing," "3D Math Museum," "SCAD Basic Operation," "SCAD Basic 3D Model," "SCAD Basic Language," "SCAD Integrated Application," and "Understanding Google SketchUp," which account for a total of 18 hours of study. Learners participate in the activities in groups of 3 to 4 people to complete daily assignments and end-of-term work.

The main features of this course are:

(1) The application of mathematics and new technology (3D printing) are combined. Because 3D modeling is the backbone of 3D printing, this course helps students understand the spatial relationship between objects using mathematical methods and creating 3D models using mathematical functions, operational math signs, and computer languages. It also encourages learners to interpret and analyze the formation of models and their structural features using
related mathematical concepts, which improve the students’ abilities to determine, analyze, and solve problems.

(2) Students gain early experience with mathematical modeling, which is an important application in the mathematical field.

(3) Inquiry-based and autonomous learning are key components. The course is taught in the computer classroom where every student can engage in self-directed learning, highlighting the use of inquiry-based learning and discussion-based learning in groups under the teachers' guidance and interpretation. Consequently, the students are encouraged to think independently in order to execute innovative designs.

(4) The openness and expansibility of teaching and learning means that each lesson has an open outcome. The students can often expand their knowledge beyond the course’s teaching objectives during computer practice, panel discussion, and completion of their assignments, while the teachers can also learn from findings presented by students. Additionally, students learn to scale the different buildings of the school based on certain parameters, allowing them to gain more experience with 3D modeling.

Innovative Teaching Practice Based on 3D Printing Technology

Taigong Primary School, Zibo

Taigong Primary School is one of the pilot schools that integrates 3D printing technology in the classroom, exploring how rapid prototyping technology can be used to promote teaching. The school has set up an "Innovation Institute" to compile students’ favorite courses; it has also set up a scientific research team to independently compile a set of 3D printing school-based teaching materials known as the “3D Printing-Dreamlike Factory” to deliver the course.

The entire course is divided into four levels. The first level allows children to learn the concept of 3D through theoretical study by mastering the basic application of 3D software; the second level helps students master the software tools through case studies with the goal of developing spatial thinking ability and comprehension of basic 3D modeling production; the third level inspires students to be creative by building objects in their minds using simple and comprehensive operations; the fourth level challenges the children to take action and print their original designs as physical products.

Each 3D printing course is split into joint learning time and individual learning time. The joint learning time is used mainly by the teachers who give instructions while students follow along with the case studies. At this point, students begin using Google Sketchup software tools to achieve single or multiple objectives. During individual learning time, students make 3D creations using their original designs, which are based on proposed requirements from teacher. When students are more familiar with the design software, the teachers guide them to find the weaknesses of their work by observing familiar designs around them, and then they ask them to propose a plan for modification, which is informed by other students’ points of views during group discussion. The goal is to improve their design and create a physical product that will confirm their design ideas. In addition, the school built a 3D work showroom that acts as a library of student work.

The 3D course pilot has achieved satisfactory results in Taigong Primary School. The students’ thinking and practice ability are actively engaged through “learning by doing,” and many praiseworthy printing works have been developed. The school also took this as an opportunity to become a demonstration school for information technology education with 3D printing as its main feature.
14. 3D Video

Digital Planet System  
*Educational Equipment Research & Development Centre, Ministry of Education*

The Digital Planet System is a new technological revolution in the field of geographical science. In 2007, the Educational Equipment Research and Development Center of the Department of Education (originally the Instructional Instrument Research Institute of the Ministry of Education) introduced the patented technology of the Dome-screen projection display (referred to as "Magic Planet" in US), which was based on the concept of digital globe technology. It integrates 3S (GIS, RS, GPS) technology, providing a digitalized, three dimensional, and steric expression of the geographic world, and has recently become an important topic for the Ministry of Education’s 11th Five-Year Plan on educational science. The Digital Planet System is being looked to as a key tool for the development of teaching resources, the research of new teaching models, and understanding the impact of its applications.

This project pioneered the integrated use of digital geographic information technology, multimedia technology, electronic whiteboard technology, and augmented reality (AR) to create an innovative geography teaching environment with the latest 3D display technology. The Dome-screen projection technology mainly solved the problems of presenting two-dimensional figures in a spherical display in addition to overcoming the limitations of static, plane, and symbol-based maps.

The Digital Planet System’s technology constructs a three-dimensional, stereoscopic, and dynamic image, which integrates map information and real remote sensory and control information to represent geographical matters, geographical phenomena, and their change process. These processes are presented in a 3D dynamic visualized expression of geographical phenomena, which displays real-time information about geographical objects’ spatial motion process worldwide. It also helps students conduct a stereoscopic observation of the earth’s environment and understand its integrity and its change processes, allowing for instruction to break through the restriction of time, space, history, and reality.

The introduction of Dome-screen projection technology and the establishment of the Digital Planet System is a major integrated teaching innovation. It has transformed instruction methods in these ways:

1. **Comprehensive integration and teaching environment innovation.** The project integrates Dome-screen projection technology, digital geographic information technology, multimedia technology, spatial information visualization technology, interactive electronic whiteboard, AR interaction, human body engineering interactive equipment technology, and other technologies. Altogether, these technologies have converged into the single Dome-screen projection technology, which used to facilitate information processing, analysis, presentation, resources, and interaction.

2. **Innovation of teaching resources.** The Digital Planet System creatively designed and developed a three-dimensional, stereoscopic, dynamic map and related geography curriculum resources that integrate innovative geography teaching strategies.

3. **Innovation of teaching methods.** The Digital Planet project constructed new teaching strategies, teaching resources, and teaching methods in the new instructional environment. It also developed an innovative framework of theory and practice for digital geography instruction.

The teaching method has been carried out in over 20 provinces and municipalities across the country under the impetus of the Educational Equipment Research and Development Center of
Ministry of Education. The system provides an interactive, exploratory teaching environment in addition to new teaching resources, teaching modes, strategies, and methods for geography instruction.

Moreover, the Digital Planet System provides strong support for the promotion of new curriculum, playing a positive role in advancing the digitization of teaching media, and it represents the evolution of geographic information. Currently, some of the curriculum’s resources have been translated into English, and have been adopted and applied by a number of schools in the United States.

15. Learning Analytics

Learning Behavior Analysis and Visualization
School of Educational Technology, Beijing Normal University

At present, the project team is exploring students’ learning behavior and visualization within an online community group using learning analytics techniques. The project team has collected multidimensional behavioral data about students’ online activities and comprehensively analyzed learning behaviors from many angles such as alternation, emotion, knowledge processing, knowledge construction, and use patterns. Using a data mining method, the project team has delivered the optimal design for presenting results of these analyses, supported the presentation of the various learning behaviors, and facilitated the students’ self-diagnosis of their learning in addition to effective intervention of the teacher’s instruction.

The project is divided into the following three research components:

1) Cooperative learning process analysis and visualization presentation based on the learning process. The project team implemented their study of cooperative learning in a real environment based on the distance education platform of Beijing Normal University. The data from the online cooperative learning process is collected by means of supporting tools in the platform, such as the asynchronous discussion area, homework submitting area, wiki collaborative editing area, resource downloading area, examination testing area, among others.

The project team built and designed the multi-dimensional analytical model that monitors interaction, emotion, participation, and knowledge processing through data cleaning and processing in order to explore the hidden learning behavior rule, interactive structural feature, emotion variation trend, cooperative knowledge distribution, interactive network evolvement, degree of contribution in participation, and other learning behavioral patterns and changes during the cooperative learning interactive procedure. They have presented the results of this multifaceted analysis using a variety of methods of demonstration including contrast, time series evolvement, and interactive visualizations, which help students learn about their own progress and knowledge level.

The results have revealed the mechanics of online interaction and the cooperative learning process. Teachers can compare and understand the learning condition, interactive mode, and process for how goals can be achieved using cooperative teams, allowing them to adjust or intervene in the learning process, and carry out the targeted adjustment and intervention of the teaching strategy in a timely manner in order to promote effective teaching.

2) The research of a system used for recommending learning resources combined with the social situation of the learning analysis. The project team begins with the learning analysis, introduces the explicit, affirmative “trust” relationship into the recommendation system research, and then the recommendation system takes advantage of social situation information in order to analyze
the mode and the rule for interactive learning behaviors. This data mining strategy is used to personalize the mechanism for recommending resources in order to present students with a visualization that can provide more intelligent, adaptive resource referral services, and offer more flexible and intelligent advice.

3) The analyses of the role of the online community as well as the topic of the learning analysis.

The project team put forward a three-dimensional hot word measurement method based on the statistical method, natural language processing method, and topic clustering, using a related data mining algorithm to enhance the accuracy of the extraction and detection of hot topics. At the same time, the project team created a visualization of the evolution of hot topics, making the variance much more obvious to users.

In the analysis of the role of the online community, the project team found one of the most important roles is that of the opinion leader. They studied four prominent features of the opinion leader in the online learning community (professional degree, novelty, influence, and liveliness), and two additional measurements (self-adhering ability and theme concentration), building a hybrid framework for the discovery of the opinion leader. Once the opinion leader is discovered, learners can directly obtain the guidance from them, encouraging them to share their constructive and meaningful viewpoints, and consequently, attain their learning objectives more efficiently.

16. Massive Open Online Courses

Beijing Digital School Creates New Public Service for K-12 Education

Beijing Digital School

Beijing Digital School (BDS) is a large-scale Internet-based virtual school constructed mainly by Beijing Municipal Commission of Education to innovate and accelerate education development and provide instruction services and support for middle and primary schools of Beijing. BDS promotes the common construction and sharing of high-quality education resources and offers education services for students, teachers, parents, and the greater community through TV, traditional Internet, and mobile Internet. Based in Beijing and extending throughout the whole country, BDS advances the systematic transformation of digital resources and has established the new public education service for the capital.

After three years of construction, BDS has begun to take shape, providing a diverse array of courses, resources, activities, and platforms among other things, with a focus on providing the support needed for developing students and teachers; constructing learning environments and resources based on realistic schools with the goal of expanding education; and, improving diversity and reach through comprehensive cooperation and deep integration. The main projects of the school are as follows:

First, BDS has developed rich, digital high-quality courses authored by key teachers across primary schools, junior high, and senior high schools. More than 20,000 synchronous courses, micro courses, and hybrid courses can be transmitted from multiple channels including the Internet, TV, WeChat, and other channels. Gathering more than 4,000 municipal special-class senior teachers and municipal- and district-level backbone teachers, the school has opened the Cloud Class of Beijing Digital School, which promotes promoted hybrid course development. It also provides courses and resources used for teachers' learning, training, and implementation, which are connected closely with curriculum and education reform.

Second, the school has carried out the online education service pilot, launched the learning information push, the online composition tutoring program, online FAQ with key teachers, and
other services. It also offers WeChat information for students and parents through their mobile
devices, providing the “Parents’ College Companion,” which is an educational guide.

Third, the school has provided a network learning space to carry out learning activities that
support open scientific practice in junior high schools. Students and teachers have their own
personal space on the network platform and TV platform, and they can participate in the highly
interactive online educational activities. A series of activities were organized during the winter and
summer vacations, which involved nearly 800,000 visitors, with a visitor volume that exceeded 8
million. At this time, more than 50,000 learning products were received.

Fourth, primary and secondary schools carried out an in-depth study to research the application of
innovative learning methods, measuring outcomes of seven characteristics in nearly a hundred
primary and middle schools. Furthermore, prestigious schools in the city and suburban county
schools formed a collaborative professional development community with Beijing Digital School
that supports classroom teaching, teachers’ pedagogical research, training for teachers, school
administration, moral education activities, and others.

The fifth project delivers high quality resources between provinces and and cities using the
network. Taking advantage of the capital’s educational resources, BDS is promoting this
intellectual output throughout China. Currently, the school has established this resource sharing
connection with Shiyan of Hubei province, Guiyang of Guizhou province, Tangshan of Hebei
province, Nanyang of Henan province, and Shifang of Sichuan province, providing more than
50,000 project-oriented account numbers to the students and teachers in the cooperative schools
so as to provide multi-grade and multidisciplinary curriculum resources.

17. Adaptive Learning Technology

101 Distance Education Net
101 Network School, Beijing

101 Distance Education Net is an intelligent adaptive learning platform which is also the first
domestic online education website for K-12 education. It assesses the user’s needs, conducts an
accurate matching, and pushes learning resources to the users by analyzing the behavioral data
from over tens of thousands of students recorded throughout 20 years of online education
experience.

101 Distance Education Net was elected as "the first national network education demonstration
base" by the National Institute of Education Sciences. In terms of learning resources, 101 Distance
Education Net is the largest domestic provider of online courses for primary and middle schools,
providing resources for nine disciplines from grade 3 primary school to grade 3 senior high school.
It has developed more than 400 textbooks, nearly 200,000 learning courses, 650,000 exam
questions, and 70,000 experimental courseware materials. The project also provides courses of
various subjects and difficulty levels including basic courses, advanced courses, integrated courses
in addition to high-definition video courses.

101 Distance Education Net offers different grading exercises, reading compositions, and
supplemental English readings, lesson plans, synchronous learning through the schoolbook,
online evaluations after class, periodic online exams, ranking contests, and a social network for
parents, which are based on the students’ learning ability and level. This intelligent adaptive
learning platform has a huge volume of resources, data sorting and label grading, and caters to
various difficulty levels.
As an instructional tool, 101 Distance Education Net provides students with an intuitive and interactive learning environment through the latest Internet and big data technology. It has compiled the learning plans of more than 20,000 front-line teachers, pushing the corresponding courses and exercises to students, supporting a curriculum system based on the “micro lesson,” so as to enhance learning efficiency. This system meets students’ needs in pre-class preview, comprehension of difficult concepts, improvement of skills, finding weaknesses and correcting mistakes, and extracurricular expansion through online interactions between teachers and students in the four learning links of learning (study, test, question, and examination).

18. Intelligent Grading Technologies

"Know Box" and "Rapid Calculation"
Beijing Know Box Technology Co., LTD, Beijing

After their official release on March 1, 2015 by Beijing Know Box Technology Co. LTD., two apps "Rapid Calculation" and "Know Box" quickly became the digital products for assignment preferred by many public schools, gaining popularity through promotion and the "word-of-mouth" effect.

"Rapid Calculation" is aimed mainly at math teachers and primary school students that need help improving their oral arithmetic ability through play. The teachers are given intelligent setting questions and are able to do mobile corrections, interact with students, and conduct learning analyses through the app. As a result, teachers have more time to do targeted tutoring specific to each student's different abilities.

"Know Box" is intended for teachers and students of junior and senior high school. The product contains millions of questions regarding 10 disciplines including math, Chinese, English, politics, history, geography, physics, chemistry, biology, and information technology.

The "questions pool" stored in the product helps teachers propose intelligent setting questions, make mobile corrections, interact with students, and conduct learning analyses. Additionally, the product can perform a multidimensional analysis of students' assignments using big data, providing the students with a diagnosis of their learning situation through the comprehensive data analysis, while offering teachers guidance for instruction customization and precision.

At present, these two apps are used in over 4,000 schools across the country, impacting more than 600,000 students and 20,000 teachers. Its most common features are the questions’ pool, intelligent setting questions, mobile correction function, interaction channel between teachers and students, and learning situation analysis. These tools greatly improve the teachers’ efficiency in planning and modifying the assignments and free them from repetitive, monotonous work; as a result, teachers can spend their free time on communicating and problem solving with students.

Moreover, teachers can use the apps to conduct big data multi-dimension analyses of students' assignments, realize targeted individualized tutoring and guidance, and determine new methods of teaching that improve students' academic performance.

19. Virtual and Remote Laboratories

Virtual Reality Laboratory
Beijing No.65 Middle School, Beijing

The Virtual Reality Laboratory of No.65 Middle School of Beijing covers 240 square meters, and is divided into three major areas: an "inquiry learning activity area" where students conduct...
independent inquiry and innovation activities, a “teaching practice area” where teachers carry out instruction practices, and a “research and demonstration area” where topic research, curriculum development, exchange, and presentation are done.

Based on computer graphic (CG) technology, computer simulation technology, artificial intelligence, sensor technology, display technology, and network parallel processing technology, virtual reality curriculum developers are conducting analyses of knowledge system architecture for each course, then establishing the scene and prop models through 3dMax, Maya, and other modeling software. They finish the corresponding key frame and role animation design from the within. The laboratory then conducts the corresponding logic development work using the universal Unity3d virtual reality engine using a logic script created by analyzing the course requirements. By using the simulation’s system computer, the laboratory has built a highly stimulating virtual experiment environment, which is a high-end laboratory that integrates virtual reality, 3D printing, and mobile learning technology.

The main functions of the Virtual Reality Lab include:

(1) Conducting the development and implementation of discipline-specific activities and practices, gradually forming interdisciplinary connections on a variety of levels (knowledge type, experience type, hands-on type, inquiry type, etc.) within a series of courses. Students can complete the independent, cooperative, and explorative learning objectives, tests, and research, which would be difficult to finish in a conventional learning environment. The lab provides the related technical foundation for students and further cultivates their ability to explore and innovate.

(2) Curriculum development incorporates the cultivation of knowledge areas and abilities pertaining to subjects such as physics, chemistry, biology, geography, etc., with the aim of improving the students’ grasp of scientific inquiry and providing the environment and curriculum resources necessary to carry out “open scientific practical activities.”

(3) The Virtual Reality Laboratory will provide teachers with a platform for conducting curriculum research, experimentation, and advancement of their professional development.

(4) The Virtual Reality Laboratory promotes the exchange of knowledge, best practices, and virtual reality course resources between schools at the regional and municipal levels.

20. Wearable Technology

Smart Wristband’s Application in K-12 Education: Exploration of “Ledong Sports”
Shunde Desheng Primary School, Foshan

Using a smart wristband and software, this project tracks the scientific feedback of students’ sports data in real-time using primary and middle schools’ physical health cloud platform. It also establishes an intelligent schoolyard culture, which supports students' physical health in a scientific way. The project implements synergistic teaching, scientific management, and the construction of an intelligent schoolyard culture through the communication between household and school based on the smart wristband. The three aspects that form an intelligent schoolyard culture are teaching, campus management, and family life, which create the “333” propulsion strategy that promotes intercommunication between teaching and management.

Three technology applications are respectively applied to the student, teacher, and parent. Students are required to wear the wristbands; teachers use “Aitice,” an application that provides special student warnings, teaching support, classroom data collection, and all kinds of project evaluations, which are summarized and added in the national students physical health data report;
parents use an application iKIDs to receive information about their child’s physical health and reminders about extracurricular sports events along with personalized strategy tips for their child; this application establishes a new parent-school communication channel about the children’s sports and their physical health.

The three streams of data are acquired during class, after class, and at home, mainly concerning heart rate, sports exhaustion limit, quantity of motion, blood pressure, and sleep quality detection, among others.

The three running logic systems collect, analyze, and provide feedback for students’ sports data based on the smart wristband, aided by the collection, analysis, and prescription processes. The collection system is used for real-time recording of the students’ sports data, tracking changes in the students’ physical activity. The analysis system is used to monitor students’ physical level and exercise habits in order to form their personal electronic files. The prescription system provides scientific advice for exercises specific to the student’s sport and physique.

In the case of campus management, the school takes into account the students’ interests and attitudes, guiding them to start exercising regularly as they are informed of its scientific benefits. The school releases the ranking list of “Little Ledong Expert” and announces the students’ sports statuses each week, so as to increase the rewards that students experience in sports. The technology also has helped students form a “Ledong Circle,” which is organized according to their individual hobbies, exercise habits, and ability levels. Additionally, professional teachers are invited to give regular lectures on healthy exercise and share knowledge about the science of sports, integrating science and technology, sports, and health, in order to accomplish the goal of “Ledong (love moving) sports, healthy growth, and lifetime benefit.”

As for the progress of the project, it helps the students enjoy and understand the science of sports, while achieving an intelligent schoolyard culture, which form the physical foundation of their personalized and multifaceted development.