Lecture Notes in Educational Technology

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Case Studies of Information Technology Application in Education

Utilising the Internet, Big Data, Artificial Intelligence, and Cloud in Challenging Times

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Introduction

The Outline of the National Medium-and Long-Term Education Reform and Development Plan (2011–2020) clearly states that information technology has a revolutionary impact on education and must be highly valued. Informatization has brought rare opportunities to the development of basic education in China, and it will certainly support and lead the development of education modernization. In the field of basic education, information technology has demonstrated extraordinary influence in improving the quality of education and teaching, innovating management models and promoting the balanced development of education. The informatization infrastructure and the network teaching environment are improving day by day, and the supply of high-quality digital education resources is constantly enriching, which provides guarantee for the frequent, universal and widespread use of informatization in education and teaching.

We are glad to see that the majority of front-line educators focus on the key issues such as curriculum construction, model innovation, evaluation and assessment faced in the reform of basic education. They stimulate the internal driving force of teachers and students to apply information technology and carry out creative practice for the key links of education and teaching. In the process, a large number of typical information application experiences with Chinese characteristics emerge. These experiences tell the local story of the application of information technology in China and reproduce the scene of the majority of educators in analyzing problems, solving problems, and reflecting on the progress. Due to the constraints of the development stage and social and cultural background of each place and school, there is still a certain gap from the deep integration of information technology and education and teaching, but it can also provide reference and reference for other regions and schools.

The National Education Conference requires "to make an overall deployment and strategic design for speeding up the modernization of education and building a powerful country in education". The basic education informatization will also take a leap from "in-depth application" to "integration and upgrading" on the "Internet +" and "Artificial Intelligence +". Therefore, the publication of this case set is particularly important at the current stage. While disseminating the Chinese voice of

the application of information technology, it also contributes to the realization of the grand goal of "supporting national modernization with educational modernization".

In recent years, China's basic education informatization has developed rapidly. As the coverage of high-quality educational resources continues to expand, the revolutionary impact of information technology on improving the quality of education and teaching and promoting the equitable development of education has achieved initial results. The application of informatization has achieved remarkable results. As one of the three key measures for China to promote the application of education informatization, "pilot first, drive the whole with parts" is China's experience in continuously leading the nationwide application of informatization.

This case collection is a staged result of the "Demonstration, cultivation and promotion plan for the deep integration of information technology and pedagogy" launched by the Ministry of Education in 2016. The project relies on central and local education departments to cultivate 90 regions and 180 schools in the field of basic education, forming typical cases covering different regions, different schooling stage, different types and different application models. Application provides a model. It provides a model for the application of educational informatization in regions and schools. Through recommendation, selection by experts, cultivation and research in various places, a batch of typical models with remarkable achievements in informatization application have been formed. They are reproducible and scalable experiences.

This case collection contains 43 cases, showing the results of the first typical cases of the application of basic education informatization. It reflects the typical experience in the construction and application of educational informatization in various regions to promote the balanced development of education and expand the coverage of quality education resources. It also reflects typical achievements of the school in the application of information technology to optimize classroom teaching, the construction of school-based resources, the change of teaching mode and the improvement of the overall influence. The case collection partly reflects the current development trend of informatization applications from "universal application" to "integrated innovation" stage and also reflects the huge potential of applying information technology to transform education processes, innovate education environment and optimize education governance. I hope this case collection could attract more people to pay attention to and participate in the discovery and sorting of cases. Through "storytelling", education concepts can be incorporated into specific details and application experience can be incorporated into perceptual materials, so as to spread the Chinese voice of information application to the world. In the new era, artificial intelligence is an important driving force leading a new round of technological revolution and industrial transformation. It is profoundly changing the way people produce, live and learn and also promotes human society to step into the intelligent era of human–computer cooperation, cross-border integration and co creation and sharing. China will attach great importance to the profound impact of artificial intelligence on education, and actively promote the combination of artificial intelligence and education, carry out educational reform and innovation, give full play to the advantages of artificial intelligence and speed up the development of life-long, equal, suitable for everyone, and

more open and flexible education. In the future, it is expected that the regions and schools in case collection will start to explore and practice intelligent education on the existing basis.

Contents

Part I
Case Study for the Application of Internet in Education

Chapter 1
Based on Information Technology, "Learning–Speaking" Action Plan: From "Micro-Class Community" Began

Xuzhou, Jiangsu Province, is an underdeveloped area in developed regions with a large proportion of rural education, relatively weak teachers, and unbalanced development of urban and rural education. There are more than 1200 primary and secondary schools in the city, more than 1.2 million primary and secondary students, and 150,000 lessons per day.

How to integral advance and effectively implement curriculum reform in the region is a problem that must be solved. At the end of 2013, Xuzhou City began to implement the curriculum reform of the "**Learning–Speaking**" **action plan** in all primary and secondary schools, with cooperative learning as the main teaching organization form. The classroom teaching method mainly takes "learning in" and "speaking out" as students' learning methods and learning objectives. The behavior of teachers and students has changed significantly with the support of information technology.

1.1 Information Technology Changes the Behavior of Teachers and Students

In the winter vacation of 2013, a number of schools such as Xuzhou No. 13 Middle School, Xiyuan Middle School, Dongyuan Middle School, and Thirty-One Middle School established a "micro-class community" on the Xuzhou Education Public Service Platform. The community organizes and implements courses on the Internet and promotes student's in class and after-class learning through a learning platform with the functions of task arrangement, organization, inspection, evaluation and background statistical analysis. As time went on, more regions and schools have joined in the construction of the "micro-class community", and finally all have been integrated into the "Pengcheng Classroom" column of the Xuzhou Education Metropolitan Area

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Network. It has formed the most powerful support for the "learning–speaking action plan", "student-oriented classroom teaching" and "learning before teaching".

An elementary school teacher in Peixian County produced the "Happy Reading 100 Lessons". Taking advantage of video transmission, under the premise of teacher's explanation, demonstration and guidance, he made full use of pictures, music, videos, etc., presented in a multimedia way to stimulate student's interest in learning and enable students to learn consciously and actively.

Quanshan District and Economic and Technological Development Zone of Xuzhou City have made changes based on the existing textbooks. They published textbooks with QR codes. If they have difficulty in doing the questions, they just need to scan the QR code behind the question. You can watch the teacher's explanation. Fenghua Street Elementary School also launched a "sounding problem solving" for wrong questions. The teacher uses the mobile phone to record the process of correcting the student's mistakes, analyzes the thinking method of solving problems through video and pays attention to the occurrence of learning.

Yunlong District of Xuzhou City, led by "digital learning experimental schools" such as Qingnian Road Primary School, Jiefang Road Primary School and gongyuanxiang primary school, has implemented "construction and Application Research of students' independent learning guidance resources" to effectively guarantee the transformation of "teaching and learning" mode. When audio, video (micro-lessons), texts (activity sheets, tutorials), animation tutorials, information learning platforms and other media are used as tools and materials for student's autonomous learning and research study, they have actually become a self-directed learning guide resource (Fig. 1.1).

Voters, clickers and point reading cards all entered the classroom. Students can use the point reading card to enable the teacher to understand the student's learning situation at the first time, carry out targeted teaching, and improve teaching strategies.

Fig. 1.1 Collaborative exploration of digital learning tool support groups

Fig. 1.2 Using interactive whiteboards for teacher–student interaction and group cooperation to solve problems

It realizes the all-round monitoring and feedback of the learning behavior of each individual student and cooperative groups. The interactive function of the whiteboard enables more students to show the learning process in real time, and the tablet computer can collect the feedback information of students in real time. "In the past, we only thought about how to learn to use one technology and one equipment. Now we think about how to make technology and equipment serve our teaching reform". The teachers said (Fig. 1.2).

1.2 Information Technology Transforms Teaching and Research Mechanism

In the curriculum reform of Xuzhou City, everyone realized that the most critical thing is not information technology, but the reform awareness of "people"; not how many devices and resources are available, but the full application of these devices and resources. Therefore, changing the teaching and research mechanism is the key.

The primary and secondary school teacher's lesson preparation and teaching research activities in the city have realized the theme topic, leading specialization, program integrity, process visualization, real-time participation and product creation. The implementation of online collective lesson preparation and **Network-based teaching** provides teachers with a broad space for communication and interaction, which effectively promotes the promotion of "**Learning–Speaking**" **action plan** and the improvement of the teacher's quality.

In Yunlong District of Xuzhou City, there are several large education groups such as Qingnian Road Primary Education Group, Xu Shiyi Attached primary school Education Group, Yunxing Primary Education Group, etc. These group schools organize teachers from several campuses to carry out online teaching and research on the platform, relying on the Xuzhou Education Bureau's **Network-based teaching** system. Experienced, high-quality schools promptly impart teaching experience and guide teaching activities to schools with shorter school history.

The teaching and Research Office of Xuzhou Economic and Technological Development Zone and the teachers in Pudong District of Shanghai City jointly carry out online teaching and research.

Xuzhou Basic Education Cloud provides public services of regional network lesson preparation. The teaching research and lesson preparation process of teachers also underwent reorganization and reengineering (as shown in Fig. 1.3).

At the beginning of 2017, the Pizhou Education Bureau organized the city's special-grade senior teacher to set up 15 online studios. Each special-grade senior teacher led five members, including some teachers from towns and villages, to share high-quality resources through the Internet, organize collective teaching and research and talk about teaching issues.

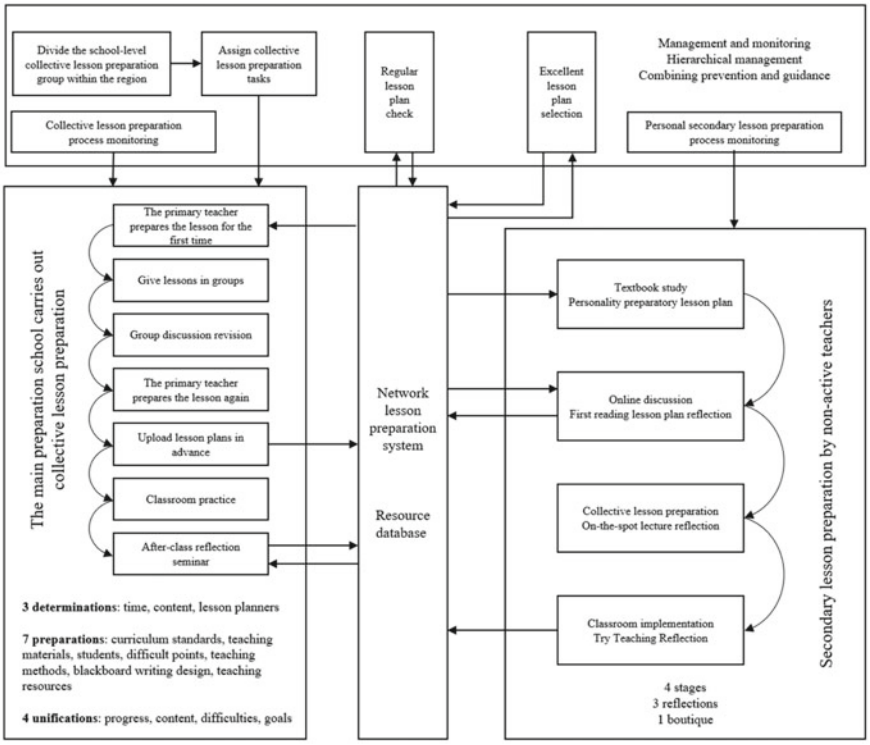

Fig. 1.3 Regional network teaching and research process based on network lesson preparation system

1.3 "Xuzhou Intelligent Class Patrol System" to Ensure the Benefit of Students

"Xuzhou Intelligent Class Patrol System" summarizes the explicit behaviors and classroom status of teachers and students in class into a series of observation indicators, which are recorded truthfully during the course of class patrol from the dimensions of teacher activities, student activities and classroom order. Through mining and analyzing the collected data, the specific characteristics of the classroom in terms of teacher teaching and group cooperation are summarized to form a panoramic description of the school's daily classroom teaching situation.

The principal can log in on the mobile phone and get first-hand information about the implementation of the "**Learning–Speaking**" **action**. Through the data, the teaching managers can easily find the problems and the direction of improvement in the course reform.

For example, in the radar chart of the intelligent **Class Patrol** system (Fig. 1.4): The student occupancy rate index is very high; however, the student's autonomous learning rate and group cooperation activity rate are very low. Systematic data analysis gives a clear description of the behavior of teachers and students, which allows us to see the problems in teaching.

The summary and analysis of **Class Patrol** data are not for "monitoring", but for research. When a teacher's classroom teaching process is transformed into big data, we can clearly understand the characteristics and habits of his behavior, so as to analyze and diagnose the problems in teaching and promote reflection and improvement.

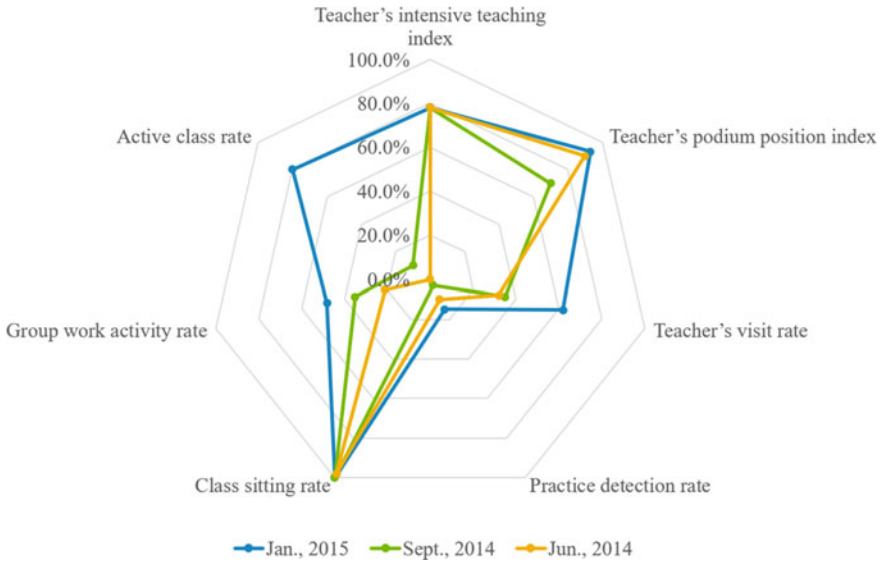

Fig. 1.4 Data analysis of the three **Class Patrol** of primary and secondary schools directly under Xuzhou City

In addition, Xuzhou Economic and Technological Development Zone pays attention to the individual differences and personalized development of students. Based on local reality, the comprehensive quality evaluation system sets four first-level indicators such as basic indicators, development indicators, specialty indicators and reward indicators. In addition, a "show" platform for student's comprehensive quality evaluation has been established. Each student can upload all the bits and pieces of his study and life in the network space through the "show" platform. It presents the educational big data accompanying the growth of students in the form of graphics, growth curve and other intuitive forms. Among them, the application of information technology in the evaluation process has distinct features. Wearing the electronic student ID card with two-dimensional code, students can break the boundaries of time and space through computers, tablets, mobile phones, etc. Students can upload their growth records, make evaluations, click to praise and pay attention to their growth performance anytime and anywhere, making the evaluation means, evaluation process and evaluation results more intelligent and visual.

More and more teachers realize that information technology can easily collect data and information, but data itself does not have value judgment, only "people" can give data meaning.

1.4 Expert Reviews

Xuzhou's "learning–speaking" action plan put forward the concept of "based on information technology" from the beginning and designed the teaching method reform and education informatization as a whole. Let information technology serve the curriculum reform and learning of students. Let new teaching methods and ideas be better practiced with the help of information technology.

Chapter 2
Adaptive Evaluation System APP Development: Achieve Project-Based Learning

Baohe District, Hefei City, Anhui Province, has 47 primary and secondary schools with 78,326 students. The focus of education informatization in the district has gradually shifted from education administration to learning management, evaluation management and course management. It highlights the central position of "learning". Baohe District uses information technology to build STEM courses with regional characteristics. It takes the mathematics adaptive evaluation and reading literacy evaluation of primary and middle school students as the breakthrough point to change the original subject and ability evaluation method.

2.1 Regional Curriculum Construction Based on Project-based Learning

Since 2014, Baohe District has implemented the officially published "Forest Classroom" Regional-specific courses in grades 3–8. The course mainly guides students to walk into nature and society and experiences the formation process of knowledge through practical activities such as independence, cooperation, experience and exploration. It cultivates student's comprehensive practical ability and innovative spirit of discovering and solving problems with the knowledge they have learned. This course guides students to feel the beauty of nature, enhances student's environmental awareness and social responsibility and promotes student's healthy, happy and sustainable development. Students are grouped by themselves and use portable instruments to measure various data of air, river, soil and ecology. Then they draw conclusions through comparative analysis and finally form written reports and select representatives to report. Baohe District has also developed the "Forest Classroom" application software (APP), which can update the content of the study in real time to facilitate the interaction between teachers and students. It is easy to record the data explored by the experiment and procedural resources. In addition, the application

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can analyze and mine the data, so as to improve the interest and effectiveness of student's research.

Baohe District has set up ten EXPERIMENTAL SCHOOLS of STEM education in primary and secondary schools in the whole region, which have made valuable explorations in the project theme, implementation process, research methods and curriculum system construction.

For example, the students in binhu Campus of the experimental school carried out research on Baogong Temple, from the historical figure Bao Zheng to the biodiversity of the waters of Baohe River, appreciation of classical gardens, and measurement of the architectural height of Baogong Temple, which fully embodies the characteristics of STEM courses. In the autocurriculum of Huizhou Elementary School, with the help of Anhui Jianghuai Automobile Company's superior resources and scientific research strength, students carry out group learning from the question list. The principles of mechanics, levers and mechanical engineering are infiltrated into the course, so that children can understand the shape and function of various parts of the car and try to design and model. In addition, the cases of other experimental schools include "Ceramic and Research" STEM series courses of Attached Primary School of Hefei Normal University, "Exploring the Subway" course of Tunxi Road Primary School, "Mysterious Bubble" course of Taihu Road Primary School, "Ecological Agriculture" course of No. 46 middle school, "STEM Research in Discovery Forest Classroom" course of Baohe middle school and other theme activities.

The classic course app of **Classical Sinology** integrates the knowledge of music, art, science and other disciplines. While learning the **Classical Sinology** students can also conduct interdisciplinary learning, which has a certain role in promoting student's cultural literacy (Fig. 2.1).

The elementary school mathematics e-schoolbag builds a knowledge framework based on knowledge points, such as "Graphics and Geometry" and "Looking for Patterns". The resources cover the sixth grade of the elementary school and contain 43 lessons. Each class has developed a set of rich and complete learning materials such as micro-lessons, texts, contacts and extension videos. Students learn micro-lessons by himself, complete tasks, read other related stories according to their own needs, watch interesting videos, and also score resource quality, giving full play to student's main position in learning. Teachers can effectively implement classroom Q&A according to the difficulties in student's self-learning process and realize efficient flipped classroom.

The Extension-Curriculum selection platform allows students to understand the course in multiple dimensions through student interest orientation assessment, course matching and target them with appropriate course based on big data operations. Let the student match with the curriculum more scientific, more reasonable.

Fig. 2.1 Classic course of **Classical Sinology**—Cover

2.2 Student Behavior Changes Based on Data Analysis

The digital reading evaluation system can record student's reading track and strengthen the reading behavior of students through gamification and honor system. By answering questions covering six major reading levels (repetition, explanation, restructuring, extension, evaluation, creativity), the system automatically evaluates the children's reading literacy.

The reading platform will regularly provide each child with a one-semester reading report. This report clearly shows the reading index of individual students, such as which books have been read, the number of readings in a semester, the type of reading, the reading ability, the reading suggestions, etc. Teachers and parents can make more targeted interventions according to the individual situation of students.

The elementary school mathematics adaptive evaluation system is based on the curriculum standards. It sorts out knowledge points from three modules: "Number and Algebra", "Graphics and Geometry" and "Statistics and Probability" and forms a mind map. According to the knowledge section of mind mapping, six questions are arranged for each knowledge point according to three levels of "simple", "medium" and "difficult". The system has rich question bank resources, and the background analysis is based on the students pretesting situation, pushing different questions to the students. Students will obtain corresponding points during independent testing and learning. The system has rich question bank resources. The background analyzes