Chapter 8
Digital Intelligence Empowerment · Paradigm Shift: Smart Practices and Ecosystem Reconstruction in the Global Digital Transformation of Education

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8.1 Introduction

In the wave of digital transformation in education, classrooms around the world are embracing educational technology innovation at an unprecedented pace. This case collection features exemplary practices from diverse countries and regions: from China's "Smart Classroom" platform supporting dual-teacher instruction, to the U.S. use of NAO robots in classrooms for children with autism, the innovative application of Team-Based Learning (TBL) by the University of Bristol in accounting education, and Australia's evidence-based research on Chinese language classrooms employing Problem-Based Learning (PBL). These cases transcend disciplinary boundaries, integrating cutting-edge technologies such as Artificial Intelligence, big data analytics, virtual simulation, and interactive micro-courses. Collectively, they illustrate how educational technology is reshaping the learning ecosystem—shifting from "teacher-centered" to "student-centered" approaches, moving from "knowledge transmission"

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C. Ren et al. (eds.), *Innovative Practices in China's Smart Education*, Lecture Notes in Educational Technology, https://doi.org/10.1007/978-981-95-2188-3_8

toward "competency development," and evolving from "standardized instruction" to "personalized learning."

8.2 Smart Education and Digital Applications

8.2.1 "Intelligent" Creation of Dual-Teacher New Classrooms, "Wise" Initiation of New Educational Quality

Guided by the principles of "new technologies, new scenarios, new connections, and new ecosystems," the school explores the application of smart education in primary and secondary schools. The school has constructed a dual-teacher classroom teaching model based on the National Smart Education Public Service Platform, covering four scenarios: teacher lesson preparation, dual-teacher classroom teaching, teacher professional development, and homework activities, forming a complete teaching loop. Teachers integrate educational resources through the platform to optimize the lesson preparation process. The school explores the lesson preparation and delivery process for dual-teacher classrooms. The school utilizes platform resources to conduct optional and thematic training. Through study groups, it organizes professional development activities to improve teachers' professional competence. Relying on the platform, the school applies the homework activity scenario, thereby achieving personalized instruction. The dual-teacher classroom model has improved classroom teaching efficiency, significantly increasing students' learning enthusiasm and participation. Through platform-based professional development activities, teachers have established effective models for professional growth. Through big data analysis, teachers can enable personalized instruction.

8.2.2 Big Data Empowers the Student Perspective, Making Growth Visible—Exploration and Practice of Precision Teaching Models Based on Data Analysis

To enhance teaching quality, the school leverages the Zhixuewang platform and big data technology to explore teaching models. The school has constructed a big data-based precision teaching model (Wan et al., 2019), primarily achieved through the following steps: Precise Test Paper Design and Data Collection: Utilizing the vast question bank resources, various forms of test paper compilation are conducted. Student answer data is efficiently collected, forming personalized error logs. Precise Learning Situation Analysis and Individualized Instruction: The Zhixuewang system automatically generates multi-dimensional learning situation reports. Teachers use

the data to precisely formulate teaching objectives and strategies. Personalized Learning and School-Home Integration: Teachers push resources based on students' individualized learning data, and assign tiered homework. The system generates student growth profiles, thereby promoting school-home integrated education. The application of precise data helps administrators identify students' learning situations, evaluate teachers' effectiveness, and support precise teaching and personalized tutoring, thereby enhancing classroom effectiveness and students' self-directed learning abilities.

8.2.3 Case Study on Digital Targeted Teaching Practice at the Middle School Attached to HUST of Science and Technology

With the advancement of educational digitization, the Middle School Attached to HUST of Science and Technology introduced the Fuli Maku Teaching System in 2021 to explore the deep integration of information technology and teaching. The Fuli Maku system optimizes teachers' lesson preparation, instruction, and tutoring processes through real-time collection and feedback of students' learning data. Its error correction scanning function provides personalized exercises to help students consolidate their knowledge. The system supports tiered assignments and targeted advanced support and remediation, as well as personalized tutoring and Q&A sessions. Furthermore, the development of school-based resources supports blended learning, and the system also utilizes multi-indicator data to drive the refinement of teaching management. The initiative has yielded remarkable results. Since July 2021, teachers have assigned tasks 178,600 times, and students have engaged in self-study 467,500 times, achieving high-frequency, routine usage. Teachers' digital literacy has significantly improved. Teaching quality has markedly risen, with record-breaking college entrance exam scores from 2022 to 2024.

8.2.4 Empowering School Quality and Efficiency Through Educational Informatization: Exploring and Innovating the Smart Education Model at Experimental Junior High School

Aligned with the National Action Plan for Educational Informatization 2.0, the school established the "Problem-Led Inquiry Informatization" teaching model. This teaching model is problem-oriented and achieves data-driven teaching decisions, multi-dimensional interaction, intelligent resources, and in-depth inquiry through three stages: before, during, and after class. Teachers optimize their teaching using

cloud platform data, while students engage in self-directed learning, classroom interaction, and receive personalized guidance with the help of resources like digital backpacks. The school also establishes a high-quality homework system, promotes interdisciplinary project-based learning, and facilitates the integration of information technology with subject disciplines. The school's smart education practices have yielded remarkable results, earning it the title of provincial demonstration unit. Both teachers and students have achieved outstanding performance, and students' initiative has been enhanced.

8.2.5 Digital Scene Application Empowering High-Quality Education Development

In response to the call for educational digital transformation, the school actively aligns with its own educational characteristics of "informatization, modernization, internationalization, and technological innovation," vigorously promoting the construction of a smart campus. Based on the smart classroom system, the school has innovated the "Contextualized, In-depth Six-Step Teaching Method" model. This model includes: 1. Identifying the core content of the discipline; 2. Setting appropriate learning contexts; 3. Posing questions that reflect the essence and thought of the discipline; 4. Organizing students' active and effective participation; 5. Guiding students' in-depth exploration and thinking; 6. Systematizing knowledge and summarizing methodologies. Meanwhile, multi-faceted technologies provide support. Smart Classroom System: Utilizing big data and cloud computing technologies to achieve comprehensive analysis of students' learning behaviors. Recording and Broadcasting System and School-Based Resource Library: Enabling teachers and students to access high-quality teaching resources at any time. Comprehensive Quality Evaluation Digital Platform: Providing all-round educational data support by quantifying students' behaviors and academic achievements. Smart Management System: Utilizing the DingTalk platform and self-built websites to achieve the digital transformation of campus management. The application of smart classrooms and school-based resource libraries has enhanced teaching efficiency and quality. Teachers can adjust their strategies based on data, leading to increased student motivation and improved digital literacy among educators.

8.2.6 "Wise" Integration, "Wise" Power: Exploring and Practicing Equitable Educational Development Through a Digital Educational Community in "Enclave Schooling"

Grounded in the contemporary imperative of balanced development of quality education, the school utilizes a digital educational community as a linchpin to explore pathways for equitable educational development within the context of "enclave schooling." It is committed to promoting high-quality and balanced regional education through smart education. The school has established a new paradigm of online-offline blended teaching based on "Independent Online Learning Spaces," "Smart Classroom Learning Spaces," and "Interconnected Learning Spaces," as well as a "Dual-Teacher Teaching" model.

8.2.7 Case Study on the Construction of a "Student-Led Smart Classroom" in High School Biology

In traditional high school biology teaching, students often remain passive recipients of knowledge, lacking initiative and engagement. This leads to low learning interest and generally poor academic performance. The school has explored the construction of a "Student-Led Smart Classroom," aiming to cultivate students' scientific literacy and innovative thinking by guiding them in self-directed and collaborative learning. Shifting Teacher Role: Teachers transition from being knowledge transmitters to guides and facilitators of student learning. Through questioning, discussions, and group collaboration, they encourage active student participation in classroom activities. Classroom Design and Resource Development: Interactive electronic whiteboards are used to present multimedia resources such as biology experiments and simulated observations. Interactive and exploratory learning activities are designed to stimulate student interest. Student Collaboration and Communication: Activities like group discussions and collaborative experiments are organized to foster interaction and cooperation among students, cultivating teamwork spirit and skills. Independent Learning and Innovation: Students are encouraged to independently search for and organize information, design experiments to verify knowledge, and develop self-directed learning and innovative thinking skills.

8.2.8 *Iterative Teaching Design for Competency-Based Classrooms Based on Artificial Intelligence Evidence-Based Research*

In response to the Ministry of Education's call to enhance teachers' digital literacy and advance the strategic action for educational digitalization, the school actively explores the application of artificial intelligence in classroom teaching, dedicated to constructing intelligent classrooms oriented toward core competencies (Yu, 2017). The school has established an iterative teaching design model for competency-based classrooms based on AI evidence-based research, encompassing three aspects: intelligent teaching design, intelligent technological interaction, and intelligent teaching methods. Intelligent Teaching Design: Teachers comprehensively prepare during the lesson planning phase, including understanding curriculum standards, textbooks, student learning conditions, technology, and assessments, utilizing AI technology to support teaching decisions. Intelligent Technological Interaction: With the help of AI technology, classrooms achieve instant interaction and evaluation.

8.2.9 *Design and Practice Research on High School Mathematics Tutoring Programs Based on Data Analysis*

To address issues such as significant individual differences among students and uneven academic performance in high school mathematics teaching, the school utilizes "Internet+" and big data technologies to explore precise tutoring programs (Yang et al., 2016). The school has constructed a high school mathematics tutoring model based on data analysis, encompassing three stages: student learning status positioning, program design, and practical adjustment. Data Analysis for Student Learning Status Positioning: Utilizing a smart education system, the school analyzes student homework, classroom performance, and stage test data to generate knowledge structure profiles, accurately identifying students' weak knowledge points. Program Design Based on Theory: Guided by the Intervention-Response model, tiered tutoring programs are designed. Practical Adjustment and Program Optimization: Through an iterative optimization process, tutoring content and methods are continuously adjusted based on student feedback and data analysis results to ensure the effectiveness of the tutoring program.

8.2.10 Digital Intelligence Integration and Personalized Development: Building a Data-Driven New Ecosystem for Smart High School Education

Shenzhen Luohu Senior High School has, since 2019, continuously engaged in the practice and exploration of building smart education based on data and evidence, implementing the "3 + e + N" teaching model. This model constructs personalized learning paths through three basic teaching links (pre-class independent learning, in-class cooperative inquiry, and post-class consolidation and improvement), the collection and application of smart data (the "e" link), and the practice of various teaching variations (the "N" link). The school utilizes platforms like 12xue to provide students with self-learning tools. Meanwhile, teachers accurately grasp students' learning situations and optimize teaching strategies through real-time data feedback, learning portraits, and knowledge graphs. Additionally, the school meets the learning needs of different students through personalized learning plans, differentiated teaching strategies, and diversified teaching activity designs.

8.2.11 Construction and Practice of an Interactive Dual-Teacher Classroom Teaching Model Based on 5G Technology

School actively explores an interactive dual-teacher classroom teaching model based on 5G technology, aiming to break geographical barriers through modern information technology and achieve the sharing and efficient utilization of high-quality educational resources. In terms of the teaching model, the school has established an interactive dual-teacher classroom involving four roles: the lead teacher, the supporting teacher, local students, and remote students. The lead teacher is responsible for course design and knowledge delivery, while the supporting teacher organizes the classroom for remote students and provides personalized guidance. Local and remote students engage in real-time interaction through 5G networks and the Classin teaching platform, participating jointly in classroom learning. This model is divided into three phases—pre-class, in-class, and post-class—each with clearly defined tasks to ensure the continuity and effectiveness of teaching activities.

8.2.12 Exploration of an Information-Based English Teaching Model for Junior High School Based on the National Primary and Secondary Smart Education Platform and Seewo Interactive Whiteboard

In the era of Educational Informatization 2.0, the school leverages the National Primary and Secondary Smart Education Platform and Seewo Interactive Whiteboard to develop an information-based English teaching model grounded in smart education. This model primarily encompasses the following aspects: Information-Based Teaching Methods: Teachers create vivid and engaging multimedia courseware to enhance the intuitiveness and appeal of instruction. Homework is assigned and online tests are organized through web platforms. Information-Based Learning Methods: The platform provides abundant learning resources, enabling students to engage in personalized, autonomous, and fragmented learning using the platform and mobile devices. Information-Based Educational Thinking: Teachers utilize information technology to analyze teaching needs, explore teaching resources, design teaching activities, and make data-driven instructional decisions, with a focus on cultivating students' information literacy and self-directed learning skills. Information-Based Teaching Content: Teachers enrich and expand teaching content using multimedia technology and online resources, achieving interdisciplinary and comprehensive curriculum design.

8.2.13 **Digital Empowerment of Education: "Internet + Synchronous Classroom" Promoting Regional Collaborative Development—"Unity Between Shandong and Xinjiang, Hand in Hand for the Future"**

In response to the practical need for promoting the balanced development of compulsory education and the context of the "Internet+," Qingdao West Coast New Area Hongwen School has, since 2019, engaged in an "Internet+ Synchronous Classroom" teaching model with the Xishan Farm School of the 12th Corps of the Xinjiang Production and Construction Corps. An interactive teaching platform enables online synchronous classrooms, joint teaching research, and communication. During lessons, the lead teacher delivers instruction and prepares teaching plans, while the collaborating teacher assists in discussing teaching strategies. The teaching assistant organizes classroom activities on the partner side, and the technical support teacher ensures the smooth operation of hardware. This model breaks spatial barriers, allowing teachers from both locations to share teaching experiences and enhance their

skills. Concurrently, the school has conducted research on "autonomous, cooperative, and inquiry-based learning," optimizing student learning strategies and boosting their classroom engagement and efficiency.

8.2.14 *Research on the Deep Integration of Information Technology and Mathematics Teaching in Primary and Secondary Schools*

In the era of Educational Informatization 2.0, the research team focused on the deep integration of information technology and mathematics teaching, aiming to enhance teaching efficiency and quality through innovative teaching models and cultivate students' core competencies. "Four Doubts" Teaching Framework for New Lessons: Guiding students to actively participate and think independently through four stages: raising doubts, introducing doubts, questioning doubts, and challenging doubts. Teachers use multimedia technology and interactive software to create vivid teaching scenarios, stimulating students' curiosity and desire for exploration. "Four-Link Mutual Promotion" Teaching Framework for Practice Lessons: Including knowledge presentation and exemplary demonstration, independent practice and feedback, enhancement checks and extension, and cooperative inquiry and summary. The information technology platform is used to distribute personalized practice questions and provide immediate feedback, promoting the comprehensive development of students' knowledge and skills. "Five-Step Enhancement" Teaching Framework for Review Lessons: Covering self-directed learning and network construction, cooperative communication and key point exploration, example exploration and skill consolidation, application extension and innovation integration, and targeted practice and immediate assessment. Mind mapping software and online learning platforms are utilized to help students systematically review and consolidate knowledge.

8.2.15 *Smart Education Empowering High School Chemistry Learning—Taking the Structure Module as an Example*

The structural chemistry section in high school chemistry, due to its abstract concepts and complex theories, has become a challenging area for students. Traditional teaching methods often fail to meet the need for students to deeply understand the knowledge, and the online teaching during the pandemic has posed even higher demands on teaching models. The lesson preparation group introduced the concept of smart education to explore new teaching models for structural chemistry (Yang & Yu, 2015). Digital Courses: Detailed and engaging explanation videos for each module of structural chemistry were recorded and uploaded to the MOOC platform, facilitating

students' independent preview and repeated viewing, thereby enhancing their self-directed learning abilities. Mind Maps: Students used XMind software to create mind maps, fostering systematic thinking and innovative abilities. Through sharing their work and teacher guidance, they also improved their critical thinking and teamwork skills. iPad Projection: Dynamic crystal cell diagrams were displayed using iPads to help students visually understand crystal structures, increasing interactivity and engagement in learning. Questionnaire Star: Quick question and answer exercises were conducted through online surveys and examination platforms, providing instant feedback and improving teaching efficiency. Nankai University Crystal Animation Material Library: Leveraging Nankai University's dynamic structural chemistry teaching resources, abstract concepts were visually demonstrated, enhancing teaching efficiency and quality.

8.2.16 Evidence-Based Research on Junior High School Chinese Digital Classrooms Under the Concept of "Problem-Based Learning"

Traditional classroom evaluations are subjective and arbitrary, focusing more on the teacher's "teaching" than on the student's "learning," making it difficult to accurately identify problems. Based on the concept of "Problem-Based Learning," the school conducts classroom evidence-based research with the help of digital platforms (Wu et al., 2023). Constructing Evidence-Based Dimensions for the Classroom: Based on the concept of "Problem-Based Learning," evidence-based indicators are established from five dimensions: student learning, teacher guidance, classroom interaction, classroom structure, and classroom cognition. These focus on students' ability to pose and solve problems, as well as the effectiveness of teacher guidance. Application Path of Digital Platforms: Evidence-based observation points are determined through teaching and research preparation. Classroom practice reflects the process of problem-based learning. Data is collected using digital platforms to form raw data for evidence-based analysis. Implementation of Evidence-Based Strategies: Teachers use the evidence-based strategy of "Observation-Analysis-Reflection-Improvement." Based on platform data, they generate "Golden Lesson Analysis Reports" to accurately identify teaching deficiencies and optimize teaching design.

8.2.17 Classroom Monitoring During Instruction in a Smart Education Environment

Qingdao Xihai'an New District Fenchilu Junior High School has actively explored digital teaching practices (Li et al., 2023), reforming traditional teaching models through the application of a smart education platform (the Changyan Platform),

with the seventh-grade Chinese lesson "The Person Who Rekindled My Life" as a practical case. The school has established a classroom teaching model based on the smart education platform, with the following key features: Pre-class Preparation and Feedback: Teachers distribute pre-class preparation packages via the Changyan Platform. Students complete the tasks and submit feedback. Teachers then compile common mistakes from the feedback to create micro-lessons for clarification, while also gathering students' reflections and questions to tailor classroom content accordingly. In-class Interaction and Monitoring: During class, teachers use interactive features to conduct real-time monitoring, providing immediate feedback on students' learning progress. Post-class Assignments and Extensions: After class, teachers assign tiered homework and provide online grading and comments. This teaching model has yielded remarkable results: Teachers can quickly collect and analyze students' learning data, improving the relevance and effectiveness of classroom instruction. Real-time monitoring and interactive features have sparked students' interest, boosting their participation and engagement in class.

8.2.18 Digital Empowerment of Full-Process Teaching Reform in Junior High School Physical Education: Learning, Practicing, Testing, and Evaluating

With the advancement of the new curriculum reform and the acceleration of smart campus construction, Chengdu wuhou experimental middle school has actively explored smart physical education teaching models (Wang, 2023). Leveraging smart physical education mobile stations, AI sports warehouses, and the "Zhihuiyun" Zhaita Smart Sports Platform, the school utilizes artificial intelligence visual algorithms and big data analysis technologies to construct a full-process smart physical education model encompassing learning, practicing, testing, and evaluating. During instruction, teachers use the smart physical education mobile stations to real-time collect students' exercise data. AI technology analyzes students' movements and postures, generating personal performance reports and providing precise guidance. Students can then engage in self-directed practice after class via the Zhaita Smart Sports app. The platform intelligently collects data and offers personalized practice suggestions, helping students overcome weaknesses and enhance their sports skills. Additionally, the school employs a home-school collaborative mechanism to break down data barriers between home and school, forming a closed loop of exercise data both inside and outside the school, thereby improving students' home exercise effectiveness.

8.2.19 Optimizing Junior High School Mathematics Teaching with Smart Education Platforms

With the advancement of educational informatization, the school has actively explored the application of smart education platforms in junior high school mathematics teaching to enhance teaching quality and efficiency. The school has established a "5 + 3" teaching model based on the smart education platform, dividing the entire classroom teaching process into 8 modules. Teachers lead 5 modules, and students engage in 3 modules, covering the pre-class, in-class, and post-class stages. Pre-class Preparation: Teachers interpret the textbooks and set pre-class assignments using resources from the smart education platform. After students complete the assignments, teachers adjust their teaching plans based on the students' performance. In-class Teaching: Teachers use information technology equipment to introduce the lesson and create teaching scenarios, guiding students to discuss key issues. Students understand the knowledge points through interaction and discussion, and teachers provide feedback and make adjustments based on student performance. Post-class Consolidation: Teachers upload teaching resources and post-class assignments, providing students with materials such as videos of expert explanations. Students complete the assignments to consolidate their knowledge, and teachers analyze the assignment data to inform future teaching. The platform has provided students with abundant learning resources and spaces for autonomous learning, significantly enhancing their learning initiative, with noticeable improvements in both academic performance and classroom participation.

8.2.20 Information Technology Empowering Contextual Teaching in High School Biology

With the rapid advancement of information technology, teachers can utilize digital resources such as images, videos, and simulation experiment platforms to create diverse teaching scenarios, thereby enhancing teaching effectiveness. Scientific History Context: By presenting electron microscope images, animations, and digitally processed historical scientific experiments, students are guided to understand the process of scientific inquiry and improve their scientific thinking skills. Life Context: Integrating real-life examples, videos demonstrate the application of biological knowledge in daily life, deepening students' comprehension and enthusiasm for learning. Social Context: Leveraging trending videos and popular science content, teaching scenarios related to social hot topics are created to enhance students' sense of social responsibility. Experimental Context: Virtual experiment software and digital methods are employed to simulate experimental processes, overcoming limitations in experimental conditions and strengthening students' practical abilities. Simulation Context: Through multimedia presentations and modeling software, abstract microscopic biological knowledge is made intuitive, aiding students in grasping complex

concepts. The creation of engaging teaching scenarios has significantly increased students' motivation and their interest in biology.

8.3 Conclusion

Reviewing these exemplary cases of smart education, we witness three breakthroughs enabled by technology in education: First, technology has broken down barriers of time and space, allowing students in remote areas to share high-quality resources. Second, data-driven precision teaching has transformed the concept of "teaching students according to their aptitude" into a tangible reality. Third, the human–machine collaboration model has redefined the ways in which teachers and students interact. Looking ahead, educational technology should pay closer attention to technological ethics, the digital divide, and teacher professional development, seeking a balance between "technological rationality" and "educational warmth." May this case collection serve as a guide for educators, inspiring more innovative practices rooted in the classroom and oriented toward the future, as we collectively write a new chapter in the digital transformation of education.

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