

Research on the Empowerment of Primary School Teachers in Ningbo Through Intelligent Technology

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This study takes Zhen'an Primary School, Wuxiang Town Central Primary School, and Fenghua District Experimental Primary School in Ningbo as case studies to explore the pathways and effectiveness of empowering primary school teachers through intelligent technology. Using questionnaires, interviews, and case analysis, the research finds that Zhen'an Primary School has optimized its integration of teaching resources through a "culture + technology" fusion model. Wuxiang Town Central Primary School leverages AI for differentiated instruction, enabling precise learning diagnostics. Fenghua District Experimental Primary School has reconstructed its educational management ecosystem through data-driven approaches. The study reveals that intelligent technologies can effectively assist teachers by reducing repetitive tasks and promoting personalized teaching and classroom innovation. However, challenges remain, including rapid technological iteration, equipment maintenance, and continuity in teacher training. Based on empirical findings, the study proposes a "Technology-Teaching-Reflection" iterative improvement model, providing practical guidance for enhancing teachers' digital literacy, optimizing instructional strategies, and advancing smart campus development, thus contributing to the construction of a human-machine collaborative educational ecosystem.

Keywords: intelligent technology, primary school teachers, educational empowerment, instructional innovation, smart campus

Introduction

Against the backdrop of the "Education Informatization 2.0" initiative, intelligent technologies are rapidly integrating into basic education. However, the core mechanisms through which they empower teachers remain to be thoroughly investigated. This study focuses on three exemplary smart schools in Ningbo—Zhen'an Primary School, Wuxiang Town Central Primary School, and Fenghua District Experimental Primary School (Ningbo

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Yinzhou District, 2024), all recognized as benchmark smart campuses by the Ningbo Education Bureau in 2024. Through multidimensional research, it systematically analyzes how intelligent technologies empower the entire teaching process—including lesson preparation, instruction, and assessment—in primary schools located in economically developed regions of Zhejiang Province.

Research Background and Objectives

The rapid advancement of intelligent technologies has brought about profound transformations in the field of education. Yet, the model of deep integration between technology and pedagogy still requires exploration. Evaluation systems for primary school teachers' digital literacy remain underdeveloped, and standardized training frameworks are lacking. This study focuses on the application of intelligent technologies to empower primary school teachers in Ningbo. It aims to explore how intelligent tools assist teachers in implementing personalized instruction, conducting precise learning diagnostics, and optimizing classroom management. The ultimate goal is to promote the modernization of education and construct smart campuses.

The selected schools are representative cases. Ningbo, as a developed city in China, has long been at the forefront of integrating artificial intelligence into educational reform. According to the 2024 evaluation by the Ningbo Education Bureau of "Ningbo Smart Campus Benchmark Schools", Zhen'an Primary School and Fenghua District Experimental Primary School were named model urban schools for this study. Additionally, Wuxiang Town Central Primary School in Yinzhou District—highlighted in a 2024 NetEase News feature for its AI-driven instructional innovation case involving differentiated teaching and equitable resource allocation—was selected as the representative rural school.

Urban schools benefit from abundant resources and a strong foundation in technology application, but they also face challenges such as rapid technological updates and increased teacher stress. In contrast, rural schools have effectively leveraged intelligent technologies to address issues such as limited teaching staff and scarce resources, though they continue to encounter difficulties in maintaining technological infrastructure and sustaining teacher training. By analyzing these representative case studies, the research aims to propose more comprehensive frameworks and solutions for empowering education through intelligent technologies.

Survey Results/Findings

Age Distribution of Respondents

Regarding the age distribution of surveyed teachers, the largest group was aged 21-25, accounting for 41.18% of participants. This was followed by teachers aged 31-40, representing 29.41%. Teachers aged 15-20 and 26-30 each made up 11.76% of the sample, while those aged 41-50 comprised 5.88%. No participants were under 15 or over 50 years old. This indicates that the majority of respondents were young to middle-aged teachers, likely due to their higher receptiveness to new technologies and greater willingness to participate in surveys.

Frequency of Intelligent Technology Use

When asked whether they use intelligent technology in their teaching, 70.59% of teachers reported frequent use, and 29.41% reported occasional use. None reported never using such technologies. This suggests a high degree of integration of intelligent technologies into teaching practices among teachers in Ningbo, Zhejiang, with most recognizing and actively leveraging the value of these tools in education.

EMPOWERMENT OF PRIMARY SCHOOL TEACHERS

Types of Intelligent Educational Tools Used

Intelligent teaching software. 100% of teachers reported using intelligent teaching software, such as Seewo Whiteboard and HiteVision Smart Classroom. This indicates that such tools are indispensable in modern teaching due to their interactivity and convenience, which are highly favored by educators.

Online course platforms. 58.82% of teachers have used online course platforms like XuetangX and Superstar Learning. This reflects the widespread adoption of online resources that enrich classroom content and support diverse learning needs.

Educational apps. 29.41% of teachers reported using educational apps such as Zuoyebang and Baicizhan. This moderate usage suggests that while these tools are helpful, their integration with subject-specific instruction may still require optimization.

Intelligent hardware devices. 23.53% of teachers have used intelligent hardware such as learning tablets and smart pens. This relatively low adoption may be attributed to factors such as high device costs and challenges in usability, indicating room for further promotion and improvement.

Impact of Intelligent Technology on Students' Learning Interest

Regarding the impact of intelligent technology on student engagement, 76.47% of teachers believed it had a positive effect and increased student interest in learning. Another 17.65% considered the impact to be very significant, greatly enhancing students' enthusiasm. Only 5.88% of teachers felt the impact was minimal. These results show that most educators recognize the positive role intelligent technology plays in stimulating student interest. However, due to differences in application depth and method, some teachers feel that the technology has not yet reached its full potential.

Overall, intelligent technology appears to have a positive influence on student engagement. Nonetheless, further improvements are needed in the promotion of intelligent hardware and in enhancing the effectiveness of intelligent tools in boosting student interest.

Issues and Countermeasures

Teachers' Understanding and Acceptance of Intelligent Technology

Although most teachers have already adopted intelligent technology, a portion of primary school teachers still lack sufficient understanding and exhibit resistance, which significantly hinders the effectiveness of intelligent technology in education.

To address this issue, it is crucial to further enhance teachers' awareness and understanding of intelligent technology. Targeted professional development activities—such as thematic training sessions and expert lectures—can introduce the advantages, application scenarios, and development trends of intelligent technologies across different subjects and teaching contexts. This will help teachers realize that intelligent technologies are not intended to replace their work but to assist in improving teaching efficiency and quality. By experiencing the benefits firsthand, teachers may be more open to integrating these tools.

Additionally, a positive environment for technology adoption must be cultivated. Schools should establish more comprehensive incentive systems that recognize and reward teachers who actively and effectively apply intelligent technologies. This can motivate broader adoption. At the same time, peer sharing and collaborative exchange activities among teachers should be encouraged to build a supportive culture of innovation.

Personalization and Precision in the Use of Intelligent Technology

While most teachers agree that intelligent technologies stimulate students' interest in learning, there are still disparities in application depth and methods, with some teachers indicating suboptimal results (Tahiru, 2021).

To achieve personalized and precise application, it is first essential to better understand the needs of both teachers and students. This can be done through comprehensive surveys and in-depth interviews that identify the specific challenges teachers face and the personalized learning needs of students. For example, differentiated surveys can be designed for teachers of various age groups, teaching experiences, and subject backgrounds to better understand their difficulties and expectations regarding intelligent technology use.

Furthermore, intelligent tools tailored to the needs of primary school teachers must be developed and implemented. These tools should be user-friendly and powerful enough to support instructional design, classroom management, and learning assessment. For instance, more intelligent lesson planning systems could be created to automatically recommend appropriate resources and methods based on a teacher's subject, teaching style, and student characteristics. Advanced analytical tools could also be utilized to provide deeper and more precise assessments of student performance, offering teachers personalized and actionable insights.

Enhancing Technical Support and Training Systems

Despite the widespread use of intelligent technologies in teaching, the adoption of intelligent hardware still has room for improvement, possibly due to inadequate technical support and training.

Schools should strengthen the development of technical support teams, not only for maintaining and upgrading equipment but also for troubleshooting issues teachers encounter during use. This ensures smooth operation of teaching activities. For example, schools could conduct regular inspections and maintenance of intelligent teaching equipment and establish efficient mechanisms for rapid response to equipment failures.

In addition, building a more systematic training system for teachers is essential. Training should not only cover the basic operations of intelligent technologies but also include strategies for deep integration with subject instruction and methods for effectively engaging students. Training programs should be tiered and phased to meet the varying needs and skill levels of teachers. For those with limited experience, basic operational training can help them become comfortable with the technology. For more experienced users, advanced training should focus on fostering innovation in teaching practices using intelligent tools.

Sustainable Development of Intelligent Technology Application

The integration of intelligent technology into primary education is a long-term and evolving process that requires sustained support in terms of policy, funding, and human resources.

Governments should increase financial investment in the application of intelligent technologies in primary education to ensure timely updates to teaching equipment, access to high-quality resources, and more systematic teacher training programs. For instance, the establishment of large-scale dedicated funds for the development of intelligent primary education could provide schools with more stable financial resources.

At the same time, collaboration with universities, research institutions, and educational technology enterprises should be strengthened to jointly advance research and practical exploration of intelligent technologies in primary education. Universities and research institutions can offer cutting-edge theoretical guidance and technical support, while EdTech companies can provide advanced products and services to support intelligent teaching practices.

Conclusion

Intelligent technology plays a crucial role in empowering primary school teachers in Ningbo. Targeted strategies addressing teachers' understanding and acceptance of intelligent technologies, the personalization and precision of their applications, the enhancement of technical support and training systems, and the assurance of sustainable development can effectively tackle the current challenges associated with implementing these technologies (Tlili, Saqer, Salha, & Huang, 2024).

By deepening teachers' knowledge of intelligent technologies and fostering a proactive environment for their use, educators can better recognize the supportive value of these tools and more actively integrate them into their teaching practices. Understanding the precise needs of both teachers and students, along with the continuous optimization of intelligent tools, enables the seamless integration of technology into various aspects of teaching, thereby enhancing educational outcomes.

Improving technical support and establishing a tiered and comprehensive training system ensure the stable operation of smart devices and equip teachers with the skills needed to use technology innovatively. Simultaneously, sustained investment in policy, funding, and human resources—along with strengthened collaboration among government, academic institutions, and educational technology enterprises—will provide a solid foundation for the long-term application of intelligent technology in primary education.

Collectively, these measures will foster the deep integration of intelligent technology with primary education, drive innovation and development in Ningbo's primary schools, and contribute to the construction of a more efficient and personalized educational ecosystem.

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