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New Opportunities, Challenges and Changes for Secondary School Teachers in the Age of Digital Intelligence

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Abstract: *In the context of the Digital Intelligence Era, the rapid iteration of generative artificial intelligence has significantly advanced the development of AI applications in education. Secondary education is undergoing profound changes, with important shifts in teachers' roles, teaching methods, and career development pathways. New opportunities for secondary school teachers, supported by digital intelligence technologies, include technology-enabled teaching innovations, data-driven personalized education, and diversified career development paths. At the same time, teachers are facing pressures related to technology integration, challenges of information overload and content quality screening, difficulties in student self-regulation, as well as concerns about data privacy and educational ethics. This paper proposes strategies to address the challenges of digital transformation, such as enhancing professional training, improving data literacy, optimizing information filtering capabilities, and fostering a collaborative educational ecosystem through home-school co-education. The aim of this paper is to provide insights for secondary school teachers to adapt to the educational changes in the Digital Intelligence Era, while offering references for future educational development and promoting the integration of digital technologies with intelligent teaching.*

Keywords: *Digital Age, Basic Education, Educational Technology, Teacher Education, Teacher Change*

1. Introduction

"Digital Intelligence" is a synthesis of digitalization and intelligentization, first introduced in the 2015 research report on the Thinking Engine by the Peking University "Knowledge Capital Foundation" project team, which also provided an interpretation of the concept of "Digital Intelligence Quotient" (DIQ). This new type of teaching environment, characterized by the integration and mutual promotion of digitalization and intelligentization, has garnered significant attention. Among them, digitalization serves as the foundation and support for intelligentization, providing the necessary training and reasoning support for intelligent innovation through digital technologies. Core underlying technologies, such as artificial intelligence, blockchain, cloud computing, and big data, form the technological infrastructure for digitalization[8]. These technologies have also promoted the intelligent upgrading of educational concepts, standards, methods, and evaluation. Intelligentization is an upgrade and expansion of digitalization; intelligent innovation enhances the automation and sophistication of digital technology applications, becoming a major driving force behind industrial transformation and technological revolution.

Currently, emerging technologies such as artificial intelligence, cloud computing, and big data provide opportunities for the digital-intelligent transformation of education[1]. Artificial intelligence, built upon supercomputing capabilities and continuously iterated and upgraded, has given rise to generative AI technologies such as ChatGPT and Sora. These technologies continually enhance the empowering functions of digital technologies, providing learners with high-quality, efficient, and diversified content generation and learning analytics tools, among others. They enable the creation of rich and in-depth predictive systems[16].

In summary, the "logic of machines" and the "consciousness of humans" are reshaping the deep transformation of education and teaching, giving birth to new forms of education and pedagogy, and driving the high-level applications and structural changes of digital and intelligent teaching.

ISSN 2522-6398 Vol. 7, Issue 12: 205-212, DOI: 10.25236/FER.2024.071229

2. New Opportunities for Secondary School Teachers in the Digital Intelligence Era

In the era of digital intelligence, the rapid development of digital and intelligent technologies has driven profound changes in the education sector, bringing unprecedented opportunities for secondary school teachers' teaching practices and professional development. Research indicates that the concept of digital intelligence encompasses multiple meanings, including data intelligence, digital intelligence, digital technologies, and digital IQ. Together, these elements form a comprehensive understanding of digital intelligence, which refers to the ability of individuals with digital IQ to utilize digital technologies to acquire and generate data intelligence, thereby supporting and enabling the process of digital transformation[19].

The term "digital intelligence" is a synthesis of intelligent digitization and digital intelligence, first introduced in 2015 by the "Zhiben Foundation" research group at Peking University in their Thought Engine report, which elaborated on the concept of "digital intelligence quotient" (digital IQ)[16]. Intelligent technologies not only enrich teaching resources but also reshape classroom structures, foster innovation in teaching methods, and significantly enhance the level of personalized education[20][23]. Moreover, the diversified career development pathways facilitated by digital intelligence technologies have expanded the professional boundaries for teachers, further supporting their professional growth.

2.1. Technology-Enabled Efficient Teaching

Under the empowerment of digital intelligence technologies, the richness of teaching resources and classroom formats has been significantly enhanced. Artificial intelligence (AI) and mixed reality (MR) technologies are notably transforming teaching methods[21]. Firstly, digital resources and intelligent teaching tools, such as electronic textbooks, virtual labs, and interactive teaching software, have broadened the range of instructional approaches available to teachers. Secondary school teachers can utilize immersive technologies such as Virtual Reality (VR) and Augmented Reality (AR) to help students understand complex or abstract concepts, making difficult-to-grasp knowledge more vivid and tangible.

Secondly, beyond enhancing classroom experiences, intelligent technologies are driving a transformation in classroom formats. For instance, through online learning platforms that offer access to top-tier educators, teachers can organize and guide interdisciplinary learning, design curriculum units that integrate knowledge across subjects, and effectively enhance students' overall literacy. Strengthening training and assessment for teachers on the use of digital intelligence platforms is also crucial.

Furthermore, the widespread adoption of smart devices and mobile applications has expanded the classroom environment beyond physical spaces into virtual classrooms. As a result, these tools enable teachers to conduct remote lessons, allowing students to interact with instructors, access learning resources, and maintain flexible schedules even from home. The connectivity of remote teaching provides educators with a diverse range of innovative teaching methods.

2.2. Digital Intelligence-Driven Efficient Personalized Education

In today's world, the application of the internet, artificial intelligence, virtual reality, and adaptive technologies has shattered traditional thinking constraints in both physical space and time. Teachers are increasingly motivated to engage in digital and intelligent teaching practices[16] (Su, 2024).

Firstly, the use of data analytics in education has made the implementation of personalized education more efficient and precise. Intelligent learning analytics tools can record and analyze students' behavioral data during the learning process, revealing their learning progress, cognitive characteristics, and preferences[6]. This allows teachers to gain a more comprehensive understanding of students' learning situations.

Secondly, teaching analysis systems based on big data and artificial intelligence are able to quantify students' learning behaviors. By analyzing information such as mastery of knowledge points, error frequencies, and response times, teachers can accurately identify students' strengths and weaknesses, enabling the design of targeted teaching strategies.

In summary, the promotion of a "teaching according to students' needs" model significantly enhances teaching efficiency, ensuring that each student receives learning support that matches their individual needs throughout the learning process.

ISSN 2522-6398 Vol. 7, Issue 12: 205-212, DOI: 10.25236/FER.2024.071229

2.3. Diversification of Secondary School Teacher Development

The digital intelligence era has brought diverse opportunities for the development of secondary school teachers. With the rapid iteration of generative artificial intelligence and the significant rise of AI applications in education, innovations such as intelligent tutoring, robot teachers, and adaptive learning are becoming increasingly prominent[15]. In response, UNESCO's "Global Guidelines for the Educational and Research Applications of Generative Artificial Intelligence," published in September 2023, provides reference principles and strategic recommendations for teachers' use of generative AI[18].

Firstly, new pathways such as offline teaching, online education, and the development of social media platforms have enabled teachers to move beyond reliance on traditional classroom instruction. Through online teaching, educators can transcend geographical limitations, expanding their teaching activities to reach a broader audience.

Secondly, online teaching also offers teachers more opportunities to showcase their educational philosophies, enabling interaction with a wider student base and further extending the influence of secondary school teachers.

Furthermore, in the context of self-media, teachers' roles are no longer confined to being "school employees" but can evolve into independent educational creators and knowledge disseminators. As a result, this diversification of professional paths broadens the career boundaries for teachers, allowing them to autonomously choose a variety of career development directions.

3. New Challenges Faced by Secondary School Teachers in the Digital Intelligence Era

In the digital intelligence era, the "human-machine" relationship significantly influences teachers' teaching behaviors, shaking the traditional dominance of teachers in the classroom[14]. "The nature of the era is now determined by technology." While secondary school teachers have gained access to an array of digital tools in their teaching practices, they also face unprecedented challenges. These challenges include the pressure of deeply integrating technology into teaching, the issue of information overload and the control of content quality, the growing demand for enhancing students' self-management abilities, and increasingly critical concerns surrounding educational ethics and data privacy protection.

The following sections will delve into these challenges in greater detail, aiming to provide targeted reflections for educators and policymakers.

3.1. Pressure of Deep Integration of Technology and Teaching

In the digital intelligence era, teachers face immense pressure in deeply integrating new technologies into their teaching practices. This pressure arises not only from the continuous emergence of digital tools and resources but also from their growing diversity and specialization. Secondary school teachers who seek to integrate digital intelligence technologies into their teaching often need to possess high levels of technological literacy as well as innovative teaching skills. However, for some teachers, the lack of systematic technical training hampers their ability to fully master the use of these tools, resulting in teaching efficiency and quality falling short of expectations [7][12][5][17][9].

Moreover, teachers must also consider how to seamlessly integrate technology with teaching content, ensuring that the use of technology is not merely auxiliary, but genuinely supports students' understanding and cognitive development. Therefore, in the process of integrating technology with teaching, teachers need to continuously improve their technological proficiency and develop the ability to transform technology into educational resources in order to effectively address this challenge.

3.2. Information Overload and Content Quality Control

With the development of digital intelligence technologies, both teachers and students are confronted with an unprecedented increase in the volume of information resources, presenting dual challenges of information overload and content quality control. Teachers must not only sift through a vast array of digital teaching materials to select appropriate content but also ensure that these materials meet the quality standards required by curriculum objectives, avoiding the dissemination of low-quality or inaccurate information that could mislead students. The process of information filtering tests teachers'

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judgment and content evaluation skills[13] .

Furthermore, teachers face challenges in guiding students to manage information, particularly in the fragmented information environment created by the internet. Teachers need to help students develop critical thinking and information literacy skills, enhancing their ability to make independent judgments. This demands that teachers possess the ability to discern reliable sources of information and integrate resources effectively, while also guiding students to navigate through the overwhelming amount of information to find trustworthy and valuable knowledge.

3.3. Educational Ethics and Data Privacy Issues

In the digital intelligence era, data-driven personalized education and assessment systems introduce new challenges concerning data privacy and educational ethics. In order to better understand students' learning needs and cognitive characteristics, teachers often need to collect and analyze large amounts of student data. However, this data collection and usage must be handled with caution, as student learning data typically involves sensitive and private information. Teachers and schools must ensure the security of data collection and storage, and strictly adhere to data privacy protection policies to avoid breaches or misuse of student information[9].

Moreover, teachers must maintain a strong ethical framework in their teaching practices, ensuring transparency in the application of technology and data usage, while respecting students' privacy rights and, when necessary, obtaining consent from students or parents.

Educational ethics also raises questions about how teachers can balance the utilitarian application of technology with a holistic approach to student development in a data-driven environment. For instance, over-reliance on data could lead to a narrow evaluation of students' academic achievements, overlooking their emotional, social, and personal development. Therefore, when using data to inform teaching decisions, teachers must not only comply with data privacy protection policies but also interpret the data objectively and comprehensively, avoiding the reduction of education to mere data points and ensuring that the essential care for students' well-being is maintained.

In the digital intelligence era, middle school teachers face multiple challenges, including the integration of technology, information filtering, student self-management, and data privacy concerns[11]. These challenges not only require teachers to continuously enhance their technological literacy and innovative teaching abilities, but also demand a heightened awareness of ethical issues and privacy protection. Moving forward, educational policymakers should provide more systematic training and support for teachers, helping them navigate the complexities of the digital intelligence environment. In addition, teachers should adopt an open, continuous learning attitude, actively exploring new technological applications in teaching to better support students' comprehensive development. These strategies are crucial for both the professional development of teachers in the digital intelligence era and the future direction of middle school education.

4. New Transformations in Teacher Education in the Digital Intelligence Era

Driven by the rapid development of educational technology in the digital intelligence era, significant changes have been brought to the teaching concepts, evaluation systems, skill requirements, and role definitions of middle school teachers, compelling ongoing adjustments and reforms in teacher education[24]. These changes have not only reshaped the way teachers work but have also introduced new demands for teacher competencies. The following sections will explore five key aspects of the new transformations in middle school teacher education in the digital intelligence era: shifts in teaching concepts, changes in educational evaluation, transformation of teacher skills, diversification of roles, and the construction of a collaborative educational ecosystem.

4.1. Shift in Teaching Philosophy: From Knowledge Transmission to a Student-Centered Approach

In traditional teaching models, the teacher primarily assumes the role of knowledge transmitter, with the classroom centered around the teacher's instruction and an emphasis on standardized learning for students. However, the advent of the digital intelligence era has driven the development of a student-centered teaching philosophy. Teaching is gradually transitioning from a model where the teacher imparts knowledge to a collaborative approach, where both teachers and intelligent systems work together to enhance the teaching process. This shift aims to continuously update intelligent

ISSN 2522-6398 Vol. 7, Issue 12: 205-212, DOI: 10.25236/FER.2024.071229

teaching methods, enable smart learning for students, and offer personalized homework recommendations, all while fostering a human-machine collaborative and iterative teaching model[10].

The integration of digital teaching tools and data analytics allows teachers to better address students' individual differences and learning needs, enabling the creation of differentiated teaching strategies[4]. In this model, teachers are no longer seen merely as authorities on knowledge but as supporters and guides in the learning process. Students, through autonomous exploration and interactive learning, are empowered to master knowledge. This transformation not only stimulates students' interest in learning but also fosters their self-learning abilities and innovative thinking. In a smart classroom, teachers must be proficient in using various digital tools to create personalized learning environments. They must increasingly adopt the role of facilitators, guiding students in deep thinking and knowledge construction through interaction.

4.2. Reform in Educational Assessment: Data-Driven Dynamic Evaluation Systems

Another significant transformation in the digital intelligence era is seen in educational assessment. Traditional examination systems typically focus on the results of standardized tests, offering static evaluations of students' knowledge mastery, while neglecting dynamic factors such as the learning process and skill development[20][25]. Digital intelligence technologies introduce new possibilities for educational assessment through data-driven dynamic evaluation systems. With these systems, teachers can track students' learning trajectories, individual progress, and skill development in real-time, taking into account not only their learning outcomes but also their problem-solving abilities, critical thinking, and innovative performance.

This new evaluation framework provides more comprehensive feedback, enabling teachers to identify students' learning bottlenecks and weaknesses, and develop more personalized intervention strategies[22]. By utilizing educational data, teachers can move beyond traditional exam-based assessments and establish process-based comprehensive evaluation systems, ultimately advancing the scientific and diversified nature of educational assessment.

4.3. Transformation of Teacher Skills: Data Literacy and Technological Application Competence

With the widespread application of digital intelligence technologies, the demand for teacher skills has continually evolved, with data literacy becoming one of the essential core competencies for teachers in the digital intelligence era. Teachers need to possess fundamental data processing and analysis skills, enabling them to extract valuable insights from large volumes of student learning data to support personalized instruction and dynamic assessments[26].

Additionally, the widespread adoption of online teaching has raised the bar for teachers' technological application skills. Teachers must master a variety of digital tools, online classroom management techniques, and behavioral analysis of students in digital environments to guide students in maintaining focus and self-discipline in virtual learning spaces. This transformation demands not only strong technical proficiency but also the ability to adapt and integrate technology into instructional design, enabling teachers to meet the ever-evolving educational environment and students' individual needs.

In summary, the digital intelligence era has brought about multifaceted changes in secondary teacher education, encompassing shifts in teaching philosophy, educational assessment, skill requirements, role positioning, and home-school collaboration models[3]. These changes not only raise the bar for teacher professionalism but also free teachers from traditional teaching models, allowing them to better meet complex and diverse educational needs. Future teacher education should focus on the integration of technological literacy and educational psychology, enhancing training in data analysis skills and the application of digital tools to help teachers effectively navigate the challenges of the digital intelligence era.

5. Strategies for Addressing New Changes in the Digital Intelligence Era

To effectively respond to the changes in the digital intelligence era, teachers must continually enhance their skills in technology application, data literacy, information filtering, and collaborative education. In light of the new transformations in teacher education under the digital intelligence paradigm, the following three strategies are proposed:

ISSN 2522-6398 Vol. 7, Issue 12: 205-212, DOI: 10.25236/FER.2024.071229

5.1. Strengthening Middle School Teachers' Data Literacy and Technology Application Training

To meet the new requirements for teacher competencies in the digital intelligence era, teacher education should emphasize the integration of technology literacy and educational psychology. It is crucial to enhance teachers' data analysis skills and proficiency in using digital tools. Specifically, teachers need to master various digital tools, online classroom management techniques, and student behavior analysis in digital environments to more effectively guide students in maintaining focus and self-discipline in virtual learning spaces. Teacher education programs should incorporate training on data analysis, including the fundamentals of data science, statistical analysis methods, and the use of data visualization tools, to improve teachers' ability to extract valuable insights from large volumes of student learning data.

5.2. Promoting the Transformation of Teaching Philosophy for Middle School Teachers

In the context of rapid technological advancements in the digital intelligence era, teachers are facing significant changes and challenges, which contribute to the phenomenon of "survival of the fittest"—where it becomes unclear who will be left behind. Teacher education should encourage a shift in the role of educators, urging them to transition from traditional knowledge transmitters to supporters, guides, and active participants in the learning process. This transformation in teaching philosophy requires teachers to leverage digital tools and data analytics to better address students' individual differences and learning needs, and to design differentiated teaching plans[2]. In a smart classroom, teachers must be proficient in using various digital tools quickly and accurately, fostering personalized learning environments. More importantly, they should play a guiding role in the classroom, facilitating deep thinking and knowledge construction through interactive learning.

5.3. Building a Data-Driven Dynamic Educational Evaluation System for Secondary School Teachers

The digital intelligence technologies of the current era have introduced new possibilities for educational evaluation. The field of teacher education should work towards establishing a data-based dynamic evaluation system. This system should be capable of tracking students' learning trajectories, individual progress, and changes in their abilities in real-time. It should also consider students' learning processes, problem-solving skills, and innovative performance. By leveraging educational data, teachers can develop a process-oriented, comprehensive evaluation system beyond traditional examination assessments, thereby promoting the scientific and diversified development of educational evaluation. This type of evaluation system not only provides more comprehensive feedback but also helps teachers identify students' learning bottlenecks and weaknesses, enabling the formulation of more personalized intervention strategies.

In the age of digital intelligence, information resources are abundant; however, issues of information overload and uneven content quality are also prevalent. Secondary school teachers need to possess strong information filtering and judgment skills in order to select high-quality teaching materials that align with curriculum objectives from the vast array of available resources. In this era, teachers must continuously engage in learning and skill development to actively adapt to the challenges and opportunities presented by this new environment.

6. Conclusion

Driven by the digital intelligence era, secondary school teachers are undergoing profound transformations in their teaching philosophies, role definitions, and professional skills. This paper analyzes the opportunities and challenges faced by teachers in the context of digital intelligence, revealing the positive impact of technology empowerment, data-driven approaches, and diversified career development on the teaching role. At the same time, it highlights the practical challenges of deep technological integration, information filtering, student self-management, and data privacy protection. In this context, teachers must evolve into "learning guides" and "growth supporters" to adapt to student-centered smart classrooms. They need to enhance their data literacy and technological proficiency, optimize teaching assessment methods, and actively engage in the construction of a collaborative educational ecosystem. To assist teachers in addressing these new challenges, educational institutions should continue to provide technology training, guidance on information filtering, and support for home-school collaboration. Future educational research should further explore the balance

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between teachers' technological literacy and teaching innovation, the protection of data privacy, and the development of students' self-management abilities. In summary, while the digital intelligence era offers vast opportunities for teachers' professional development, it also demands continuous adaptation and updates to meet the complex demands of educational transformation.

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