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A Study on the Path of Digital Education to Empower a High-Quality and Balanced Basic Public Education Service System

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Abstract. Against the background of digital transformation and the development of a leading education powerhouse, promoting the establishment of a high-quality and balanced basic public education service system is key to achieving educational equity, and digital education serves as a vital driving force in advancing this system. This study takes the essence and structural composition of the system as its starting point. By analyzing relevant data and materials, it explores—from a systemic perspective—the intrinsic connections, practical challenges, and implementation pathways of digital education to empower the development of this system and address gaps in existing research. The study found that digital education can effectively overcome spatial and temporal constraints, thereby facilitating the allocation of high-quality educational resources in a more balanced way. However, today's empowerment process mainly faces several challenges, including resource supply, teaching services, and teacher development, and lacks comprehensive institutional governance safeguards. Therefore, this study proposes a systematic empowerment framework of "optimization of the three major components + institutional governance safeguards throughout the entire process," based on four interrelated aspects: optimization of resource supply, integration of technology into teaching services, enhancement of teachers' capabilities, and institutional governance safeguards.

Keywords: Digital Education; High-Quality and Balanced; Basic Public Education Service System; Educational Equity.

1. Introduction

Over the past 30 years, China has made major advances in the equalization of public education, with indices across various dimensions showing a steady upward trend. In particular, the comprehensive index for the equalization of basic public education services has risen from 0.0026 to 0.6661 [1]. Recently, China has continued to advance the process of equalizing basic public education services and has implemented a series of measures for this purpose, such as universalizing nine-year free compulsory education to enhance the inclusiveness of education; reforming the public education funding system to steadily increase investment in education; improving school facilities in rural areas and supplementing them with high-quality teaching staff to narrow regional development gaps; and simultaneously focusing on safeguarding the rights of students with special needs. By reviewing and analyzing relevant policies, some scholars have divided the development process of the equalization of basic public education services into four stages: the stage of striving to expand supply, the stage of fully promoting balance, the stage of standardizing and coordinating resource allocation, and the stage of balanced development of high quality. Although China's public education services have reached the stage of high-quality and balanced development since 2020, they currently still face challenges such as significant disparities in educational financial support across regions and uneven allocation of resources between urban and rural areas [1, 2]. These current situations reflect that the basic public education service system still must be constantly improved and optimized.

Against the background of digital transformation, the role of digital technology in the domain of education has become increasingly prominent. The feature of digital resources makes them different from traditional educational resources and is not limited by time and space, so they can promote the balanced allocation and fair sharing of resources. Based on the research and analysis of China's

provincial panel data from 2012 to 2022, some scholars have found that digital technology has remarkably promoted the equalization of public education services, and this effect is more obvious in areas with low digital intelligence, low education equalization, and high human capital [3]. However, the application of digital technology also faces some challenges, such as the digital divide and insufficient resource adaptability, so a systematic optimization path is needed to achieve more effective utilization. China attaches great importance to the development of education equalization and the integration of digital technology and education. Through a series of policies from 2021 to 2025, China aims to establish a high-quality and balanced basic public education service system through the integration of digital technology and education, and has set goals to be achieved in 2027 and 2035 [4, 5, 6, 7]. Based on the current actual needs and policy orientation, it is of great practical significance and research importance to probe into the logic, existing problems, and implementation pathways of digital education to empower the system around the implication and composition of the high-quality and balanced basic public education service system.

2. Literature Review

2.1. Core Concepts

Basic public education services refer to the basic public services provided in the domain of education. These services have the four primary characteristics of public, inclusiveness, basic, and development. These are the services that are of the greatest concern to the entire people, closely related to their most direct and realistic interests [8]. High-quality balance is a higher pursuit on the basis of basic equalization. By expanding the supply of high-quality resources and improving the quality of educational resources, resources can be allocated more fairly, so as to promote educational equity. From a systematic perspective, the system is mainly composed of three main parts: resource supply, teaching services, teacher construction, and the institutional guarantee throughout the whole process. In the system, the resource supply part is the foundation pillar, the teaching service part is the key hub, the teacher construction part is the important body, and the institutional guarantee part is the core of the whole process and stabilizes the whole situation. These four parts are closely related and have an important impact on the development of the system. Under the trend of digital transformation, the empowering effect of digital education is to optimize and improve the four parts, thereby helping the development of the system and finally achieving the goal of high quality and balance.

2.2. Present State of Research at Home and Abroad

Many scholars have made rich discussions on the connection between digital education, educational equity, and the balanced development of education. Domestic research mainly focuses on policy evolution and practice path. Han Shimei systematically sorted out the policy evolution of China's education informatization to promote equity in education. She believes that from "Networks Between Schools" and "Modern Distance Education for Rural Schools Project" to "Connect-Schools, Content, Spaces (SCS)", informatization has always focused on expanding access to high-quality resources, but it is necessary to be alert to the problem of "digital divide" [9]. Du Shangrong analyzed the evolutionary logic of the high-quality and balanced policy of urban and rural compulsory education, and pointed out that the policy exhibits a phased progression from imbalance to basic balance and then to high-quality balance, emphasizing that the policy needs to change from guaranteeing the bottom to promoting excellence, from vagueness to clarity, and from misplacement to return to position [5]. Fu Suhao et al. built a theoretical system for the high-quality and balanced development of urban and rural education in the background of the transformation of digital education, and proposed the three empowerment paths of cross-regional supply of high-quality educational resources for digital ecological empowerment, multi-party collaboration to build a shared creation education community, and restructuring the training model of rural teachers [4]. Based on field research, Chen Kun et al. pointed out that informatization helps to share curriculum resources, support the development of teachers, and improve the learning quality of disadvantaged groups, but it faces

practical dilemmas such as insufficient resources for appropriate courses, delayed overall planning, and digital divide [10]. Yang Jupeng analyzed the policy logic of the transformation of digital education in the new era and emphasized the change orientation of "four-dimensional drive" (trial, manpower, function, goal) and "people-centered logic" [11].

International research generally believes that digital education is an important tool to improve educational equity. Facer and Selwyn proposed "non-stupid optimism", emphasizing that digital technology needs to serve to solve social inequality, not simply technology replacement [12]. Lynn pointed out in the chapter of "Digital Education" that digital technology can support formal and informal learning, but needs to pay attention to access equity in rural and remote areas [13]. Deichakivska et al. show that interactive online tools (such as virtual laboratories) can significantly improve the reach and effectiveness of learning in isolated areas [14]. Zawacki-Richter and Bozkurt summarized the research trends of open, distance, and digital education, pointing out that the 3M framework from macro-system to micro-teaching provides a structured analysis for digital transformation [15]. Alenezi et al. analyzed the challenges and opportunities of digital integration of higher education, emphasizing that teachers' digital literacy and infrastructure are key points [16].

Based on the above literature, existing studies at home and abroad have fully proved that digital education plays a positive role in promoting educational equity and the balanced development of education. It has clarified the core connotation and theoretical logic of digital education. At the same time, it has deeply explored the difficulties encountered in practice and put forward corresponding solutions. These documents provide a solid theoretical foundation and empirical support for this study. However, most of the existing studies lack exploration from a systematic perspective. Some studies only focus on a single perspective, such as the balance of urban and rural education development and teacher development. Most of the explorations on existing dilemmas and paths are only scattered or outline the construction of the system from the macro level, and there is a lack of systematic exploration of the connections and relationships between the various parts of the system. On this basis, this study takes the core connotation and composition of the system as the starting point. From a systematic perspective, it explores the relationship between all parts of the system and the intrinsic connection, actual challenges, and realization path of the system of digital education empowerment construction, hoping to make up for the shortcomings of existing research.

3. Challenges Faced by Digital Empowerment in Education in Practice

3.1. Resource Supply: Uneven Allocation of Digital Resources and Insufficient Adaptability Between Supply and Demand

Resource supply is the basic pillar of the basic public education service system, the purpose of which is to reflect the inclusiveness and fundamentality of the system. However, digital educational resources currently face the same issues of uneven distribution as traditional educational resources. At its core, this stems from an insufficient total volume of high-quality educational resources and an irrational regional distribution, which in turn leads to the prioritization of efficiency in the allocation process [9]. This manifests in the following ways: First, there is spatial imbalance in allocation, with high-quality digital educational resources still concentrated in developed eastern regions and urban schools, while schools in rural and remote areas suffer from insufficient digital resource supply, causing the "digital divide" between urban and rural areas and across regions to widen continuously. Second, there is a mismatch between supply and demand. The development of digital resources has not fully accounted for developmental disparities and actual teaching needs across regions, urban-rural areas, and schools. This results in a mismatch between integrated, standardized resources and local realities, with some blindly invested digital resources potentially becoming a burden for schools in less-resourced areas, thereby creating a new "digital divide" [10, 17]. One of the core problems that causes the above actual dilemma is the lack of a system for the construction, allocation, and sharing of digital resources coordinated by the whole country and supplemented by localities, so the resource barriers cannot be broken.

3.2. Teaching Services: Shallow Integration of Digital Technology and Educational Services

Teaching services are the key hub of the system. Its goal is to reflect the development and public nature of the system. At present, there is still a superficial problem of "emphasizing technology and neglecting education" in digital education, which has failed to truly empower teaching services to improve quality and efficiency, and inclusive sharing. Currently, most educational digital applications are still centered on technical tools, ignoring the differences in educational requirements among different regions and groups. The application of technical resources is mostly at the shallow level of teaching content display, and fails to deeply integrate with various teaching links [2, 4]. This directly leads to the inability of digital technology to effectively make up for the shortcomings of teaching services in underdeveloped areas and schools, and the inability to use resources and equipment efficiently, thus the purpose of inclusiveness and development of basic public education services cannot be achieved. One of the core problems causing the above dilemmas is the lack of a unified system of quality standards, application, and supervision of digital teaching services, so it cannot guide the profound integration of educational services and digital technology.

3.3. Teaching Development: Uneven Digital Literacy and Insufficient Application Ability Among Teachers

Teachers are an important subject of the system. However, due to the uneven development of urban and rural areas, high-quality teachers are inclined to urban and developed areas. Compared with teachers teaching in urban areas, teachers who teach in rural areas have few opportunities to learn and train, which makes it difficult to improve their digital literacy, and the application ability of digital technology is low. This gap in literacy and ability directly leads to the obstacle to the development of digital literacy in rural areas, leading to the chain problem of a mass of high-quality digital resources in underdeveloped areas that are "available but cannot be used, used but not used effectively" [4, 17]. One of the core problems that causes the above practical dilemma is the lack of an effective and sustainable teacher digital literacy training system and incentive evaluation system, which leads to the inability to stimulate the internal drive of teachers, thus the goal of jointly improving the digital literacy of teachers in all areas cannot be achieved.

3.4. Institutional Safeguards: Imperfection Whole-Process Guarantee Mechanism

Institutional safeguards are the core of the whole system and the stability of the whole situation, and the core means to solve the above three major dilemmas. The lack of systematic institutional guarantee covering the whole process in the current transformation of digital education is a common problem that many scholars believe. Specific manifestations include: first, an incomplete resource allocation coordination mechanism and the absence of nationally unified standards for digital resource development [9]; second, a lack of standardized digital teaching service norms and oversight mechanisms, with no unified standards for digital teaching applications or quality evaluation, thereby failing to provide effective guidance for the deep integration of digital technology and education; third, the teachers' digital literacy training system and incentive evaluation system are incomplete; digital literacy and the outcomes of digital teaching have not been incorporated into the indicators for teacher performance evaluations, resulting in insufficient intrinsic motivation among teachers [6, 10]; fourth, the assessment and accountability mechanisms for policy implementation are inadequate, leading to inadequate enforcement of relevant policies and poor implementation outcomes. These are the core reasons why the three major challenges mentioned above have not been effectively resolved.

4. A Systematic Approach to Digital Transformation in Education

First, in terms of optimizing the supply of resources, establish a mechanism for the provision of digital educational resources that is coordinated at the national level and supplemented by local authorities. According to the requirements of regional, urban, and rural and inter-school coordinated development outlined in policies issued in 2023, and in keeping with the foundational and universal nature of basic public education services, the government should establish a digital education resource sharing

mechanism of "national coordination and local supplementation" [3]. Tailored support plans should be formulated based on regional differences to address the challenges of uneven resource allocation and insufficient adaptability, thereby promoting the reduction of the resource gap [17].

Second, at the level of optimizing teaching services, promote the deep integration of digital technology with educational services to support personalized services. Closely aligned with the developmental and public nature of basic public education services, and shift the focus of digital education centers from technology to people, achieving a deep integration of digital technology with the core values of education. Promote the integration of online and offline teaching, launch personalized services, establish digital teaching service standards and supervision mechanisms, formulate unified and standardized digital teaching applications and quality evaluation standards to promote the effective use of resources, and no longer be superficial [6].

Third, in terms of optimizing teacher development, build a digital literacy training framework and an evaluation incentive system for teachers. By building new infrastructure and integrating relevant resources, a regional and tiered training system and incentive evaluation framework can be created for teachers' digital literacy. Leveraging digital platforms, this approach can enhance teachers' digital literacy and their ability to apply digital technologies, with a particular focus on cultivating and developing teaching talent in rural areas [2, 18].

Fourth, in terms of optimizing institutional governance safeguards, it is essential to improve a comprehensive, systematic institutional safeguard mechanism for educational digitization. Aligning closely with the characteristics of public nature, the government should establish an institutional safeguard mechanism that spans the entire process—from resource provision and teaching services to teacher development—to provide systematic support for the optimization of these three key components. Improve the coordinated resource allocation mechanism and establish nationwide unified standards for digital resource development [9]; establish norms and oversight mechanisms for digital teaching services, formulate unified standards for digital teaching applications and quality evaluation, and provide effective guidance for the deep integration of digital technology with education; refine the teacher digital literacy training system and incentive evaluation system to stimulate teachers' intrinsic motivation [6, 10]; improve the assessment and accountability mechanisms for policy implementation to ensure the effective operation of the mechanism, continuously optimize top-level design to ensure that relevant policies are fully implemented and effectively put into practice, promoting the development of educational digitization [3, 6].

5. Conclusion

Starting from the essence and systemic structure of a high-quality and balanced basic public education service system, this study analyzes and finds that digital education can effectively overcome spatial and temporal constraints and promote the balanced allocation of better educational resources, thereby empowering the system to achieve the goal of high-quality and balanced education, and ultimately advance educational equity. However, in the current empowerment process, it mainly faces an uneven distribution of digital resources and insufficient adaptability between supply and demand. The integration of digital technology and educational services remains at a shallow level. Teachers' digital literacy development is uneven, and their digital application skills are insufficient, with an imperfect guarantee mechanism for the whole process. At the same time, there is a lack of institutional governance guarantees throughout the whole. Based on the above dilemmas, this study puts forward a systematic empowerment path framework of "optimization of the three components + institutional governance guarantee throughout the whole process" from the four interrelated aspects of resource supply optimization, technology integration, teaching services, teacher literacy improvement, and institutional governance guarantee. However, this study mainly relies on second-hand data and information, focusing on the systematic path framework at the macro level. It lacks field research and empirical data. In the future, it can further optimize the practical path by studying typical cases and existing practical data, so as to enhance the empirical and universal applicability of the study.

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