

Practical Strategies for Digital Empowerment to Improve the Quality and Efficiency of Infant Care Services

Wen Li, Wei Peng

School of Economics and Social Welfare, Zhejiang Shuren University, Hangzhou, Zhejiang
310015, China

Abstract

Digital technologies based on big data, artificial intelligence, Internet of Things and cloud computing play an important role in promoting the high-quality and efficient development of childcare services in China. By analyzing the current situation and characteristics of infant care services, the embodiment and application of digital technology in childcare services, and typical cases of digital-enabled childcare services at home and abroad, this paper discusses how to solve the challenges faced by the infant care industry through digital means in the context of the new era, so as to meet the needs of the society for the development of high-quality and high-efficiency childcare services.

Keywords

Digital Technology; Childcare Services; Quality and Efficiency; Practice Strategy.

1. Introduction

In recent years, with the rapid development of science and technology, and the introduction and implementation of the 'comprehensive three-child policy', the status of infant care services at the national strategic level has become increasingly prominent, and has received extensive attention from all walks of life. In 2019, the General Office of the State Council issued the "Guiding Opinions on Promoting the Development of Infant Care Services for Children under 3 Years of Age," which emphasized the importance of technological innovation for infant care services, and advocated the active use of Internet, big data, Internet of Things and artificial intelligence. Frontier technologies such as intelligence, deep integration with care service practices, development and application of information management systems. This measure aims to promote the integration of online and offline resources, which can not only enhance the service experience, but also strengthen the management efficiency and data monitoring ability, and improve the level of care services in an all-round way. Subsequently, in 2021, the "Decision of the Central Committee of the Communist Party of China and the State Council on Optimizing the Fertility Policy to Promote the Long-term Balanced Development of the Population" further clarified the direction, and proposed to promote the development of emerging service models such as "smart childcare." It provides an innovative path to meet the challenges faced by the childcare industry and guides the industry to a more intelligent and efficient transformation path[1]. The introduction of digital technology provides a new path and possibility for the transformation and upgrading of infant care services. Through intelligent management, data analysis, online service platform and other means, digital technology can not only significantly improve service quality and security, but also effectively improve operational efficiency and solve the problem of uneven distribution of resources.

At present, there is still a mismatch between supply and demand in the quantity, structure and quality of infant care services in China[2], The contradiction between supply and demand of childcare services is prominent[3]. With the liberalization of the comprehensive "three-child policy" and the increase in the proportion of professional women, the demand for professional

childcare services for families of infants aged 0-3 years has surged. Although the government has issued a number of policies to encourage the development of the childcare industry, such as adding inclusive childcare institutions and providing subsidies, there are still many problems such as imbalance between supply and demand, high prices and lack of quality assurance[4]. Therefore, it is necessary to actively promote the digital and intelligent transformation of traditional childcare services[5]. Most of the infant care systems in developed countries are more perfect, and more emphasis is placed on government-led and market parallel, which can provide diversified service choices from public to private and meet the needs of different families[6]. For example, through the high welfare policy, the Nordic countries have constructed a childcare service system with the characteristics of multi-agent participation, 'friendly' policy support, hierarchical management system and standardized supervision and evaluation[7]; Japan ensures the quality of childcare through a strict qualification certification system[8], It also actively promotes the application of intelligent technology in childcare services, formulates a 'regional IoT implementation roadmap', popularizes the Internet of Things (IoT) to all childcare institutions, and proposes to comprehensively utilize information technology (ICT) to build a childcare service system for infants aged 0-3 years[9]. The practical experience of these countries shows that perfect policy support, high standards of service norms and technological innovation are the key to improving the level of childcare services. Digital technology has obvious potential to improve the quality and efficiency of childcare services. However, at the same time, there are also some problems that cannot be ignored. For example, how to fully explore the value of data on the basis of ensuring the safety of children's personal information; how to create an interactive interface that meets both parents' expectations and digital requirements; through which policies and technical approaches can narrow the gap between urban and rural areas in the digitization of childcare services. Therefore, based on this research background, combined with typical cases, this paper analyzes and discusses the practical strategies of digital empowerment to improve the quality and efficiency of infant care services, in order to promote the improvement and development of infant care services in China.

2. Embodiment and Application of Digital Technology in Childcare Services

The application of digital technology in infant care services is mainly reflected in data management, intelligent monitoring, online service portal and customized education services. The in-depth application of these technologies, with their predictability and innovation, is reshaping the pattern of the industry, providing solid support for improving service quality, optimizing resource allocation, ensuring children's safety, and achieving more sophisticated management.

At present, most of the integrated care service system for infants and young children constructed by digital technology includes the following subsystems (as shown in Figure 1-1 below): ① Data-driven supply and demand forecasting and accurate matching system. It includes two parts: hardware and software. In terms of hardware, wearable health monitoring devices, environmental sensors and smart cameras are deployed. These devices can automatically collect infant health information, environmental data and activity videos. In terms of software, a cloud data center is established for data storage, cleaning and integration to ensure data security and ease of use. ② Security monitoring and early warning system supported by the Internet of things. AI image recognition technology is used to integrate artificial intelligence monitoring and environmental regulation functions to monitor the safety status of infants in real time, identify potential risks and issue early warnings. At the same time, the system can also be linked with smart devices to automatically adjust the indoor

temperature, humidity and air quality, and create a comfortable and healthy growth environment for infants and young children.③ Online service and efficient operation management system. Including home interaction and service reservation management. It can provide services such as home co-education log, growth record sharing, and online consultation, and strengthen exchanges and cooperation between parents and childcare institutions. At the same time, parents can also conduct online registration, fee payment, course selection, leave and course adjustment, which simplifies the operation process and improves management efficiency. 4 Personalized education and evaluation system. Including growth assessment and intelligent recommendation of educational content. Through data analysis, the system can regularly generate infant growth reports, evaluate their development level, and provide personalized intervention guidance. At the same time, the system can also intelligently recommend early education resources and activities suitable for infants and young children according to their interest preferences and growth needs. 5 Support and guarantee system. Including technical training and compliance with policies and regulations. It can provide training in the use of digital tools and data analysis for caregivers to improve their professional skills. At the same time, monitoring the operation of the entire system is to comply with relevant laws and regulations such as data protection law to ensure legal compliance with data collection and use. In addition, a feedback mechanism is established to continuously optimize services and upgrade technologies based on operational data and user feedback.

Through the implementation of the above framework, infant childcare services can make full use of digital technology, which can not only improve the quality and efficiency of childcare services, but also enhance parents' sense of participation and trust, and provide a safer, healthier and more beneficial growth environment for infants and young children.

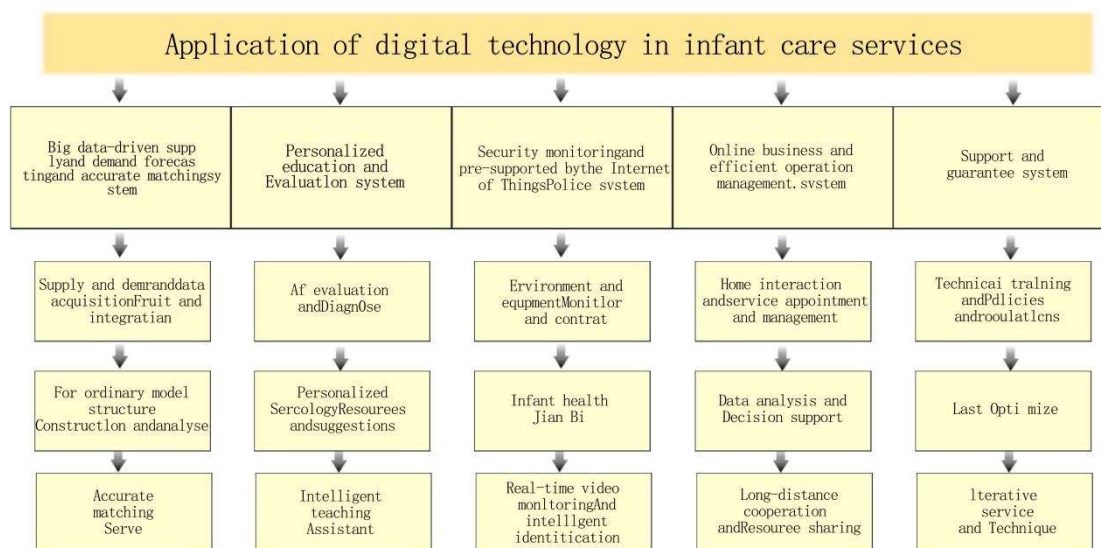


Figure 1. System Framework for Digitally Empowering Infant Care Services

3. Typical Case Analysis of the Development of Digital Empowering Childcare Services at Home and Abroad

At present, many positive explorations have been carried out at home and abroad in the use of digital technology to develop childcare services, and some successful cases and experiences have been accumulated. In China, there are childcare service platforms such as 'Tuoyoubao', 'Baby Tree', 'Childcare Cloud', 'Smart Childcare Cloud Platform' in Hangzhou, and 'Nantong 0-3-year-old Infant Care Service Supervision Platform'. Abroad, there are comprehensive childcare management software 'Bright Horizons' in the United States, the application

Kinderly ' designed for early educators and parents in the United Kingdom, Canada 's childcare communication and recording platform ' Hi Mama ' and the widely used application ' Daily Connect ' around the world.

3.1. Domestic Case : ' Tuoyoubao ' Intelligent Nursery Cloud Platform

The ' Tuoyoubao ' intelligent nursery cloud platform is developed by Tuoyoubao (Chengdu) Information Technology Co., Ltd., aiming to promote the digitization and intelligence process of the nursery industry. The platform includes nine systems : park management system, enrollment management system, home co-education system, teaching management system, book management system, financial management system, personnel management system, headquarters management system and educational administration management system. It can provide services such as safety care, home co-education, intelligent enrollment, scientific operation, and optimization of courses. The digital implementation path of Tuoyoubao intelligent nursery cloud platform mainly focuses on the following key steps: (1) Demand analysis and strategy customization: In-depth communication with nursery institutions, clarify existing management processes, challenges and goals, and customize personalized digital strategies and implementation blueprints accordingly to ensure that the scheme is feasible. (2) System deployment and personnel training: Complete the internal deployment of the platform, involving software installation, data migration and system configuration. At the same time, professional training is organized to improve the digital skills of teaching staff and ensure the effective use of the platform. (3) Data integration and optimization : integrate student information, health records, curriculum and other data to the cloud platform, unified management and in-depth analysis, through data insight to optimize the operation process, improve management efficiency. (4) Construction of home-kindergarten co-education system : build online home communication mechanism, such as parent APP, realize parents ' real-time monitoring of children 's school situation, including health, learning progress, etc., strengthen home cooperation and enhance mutual trust. (5) Intelligent hardware integration : introduce intelligent devices such as health monitoring and environmental monitoring, automatically collect and transmit data to the cloud platform in real time, and strengthen the quality and safety of care. (6) Curriculum and teaching quality improvement : using rich educational resources and teaching management system to optimize curriculum design, combining data analysis to evaluate teaching results, constantly optimize curriculum content, and support personalized learning. (7) Operation and marketing strategy upgrade : With the help of the platform 's intelligent enrollment module and marketing tools, market analysis, customer portrait construction, implementation of precision marketing strategies, and improvement of enrollment efficiency and brand influence. (8) Continuous iteration and technical support : constantly update the platform functions according to user feedback, maintain the technological frontier, and provide instant technical support to solve the problems encountered by users in use. (9) Effectiveness evaluation and continuous improvement : regularly evaluate the results of digital transformation, pay attention to key indicators such as operational efficiency, parental satisfaction and business expansion, dynamically adjust strategies according to the evaluation results, and form a continuous improvement mechanism. Through this series of orderly steps, Tuoyoubao intelligent childcare cloud platform has helped childcare institutions achieve a comprehensive digitization from management to service, which not only improves work efficiency, but also enhances parents ' trust and participation, and jointly promotes the high-quality development of the childcare industry.

3.2. Foreign Cases : Bright Horizons, an Online Parenting Service Platform in the United States

Bright Horizons is an American childcare brand founded in 1986, dedicated to providing the highest quality of education and care. At present, Bright Horizons has more than 26,000

employees around the world. With honesty, excellence, responsibility, respect and teamwork as the guiding principles, Bright Horizons cooperates with the world 's most successful employers to give working families the support they need.

The digital implementation path of Bright Horizons includes the following points : (1) Online service platform : Bright Horizons provides a comprehensive online service platform, parents can complete the whole process from registration, booking visits to daily communication. The platform integrates video surveillance, scheduling, event notification and other functions. (2) Personalized learning plan : Use AI technology to analyze children 's development data, tailor learning plans for each child, and provide personalized teaching resource recommendations for teachers. (3) Data analysis-driven decision-making : By collecting and analyzing operational data, such as employee satisfaction, parent feedback, child development milestone achievement rate, etc., the service strategy is constantly adjusted and optimized.

After the platform is online, it has achieved good results. It achieves efficient family and institutional communication and improves the level of personalization of services. Its data-driven decision support system improves management efficiency and quality control capabilities. It also promotes the personalized development of children and enhances the sense of participation of parents.

4. Digital Empowerment to Enhance the Challenges and Difficulties Faced by Infant Care Services

Although globally, there have been some successful cases of digital empowerment in the field of childcare services, and a wealth of practical experience has been accumulated. However, it is undeniable that there are still a series of outstanding challenges and obstacles that need to be properly addressed and overcome. (1) Technical cost and popularization problems : Digital transformation requires high initial investment, including hardware and software acquisition, system development, maintenance and upgrading, etc. This is a big burden for many childcare service institutions, especially small and medium-sized institutions, and limited funds may limit the application and promotion of advanced technologies. (2) Data Security and Privacy Protection : Collecting and processing personal information of infants and parents involves highly sensitive data security and privacy issues. How to ensure the security of data in the process of transmission and storage and prevent data leakage is an important challenge that the childcare service platform must face. (3) User acceptance and staff training : Whether the staff or parents of childcare institutions, the acceptance and proficiency of the new system are different, and a lot of training and guidance are needed to ensure the effective application of the platform. Small-scale institutions may lack sufficient resources to continuously train employees. (4) Fairness issues : The digital divide may lead to uneven distribution of resources. There may be differences in the enjoyment of high-quality digital childcare services between urban and rural families with different economic conditions, which may aggravate the unfairness. (5) Compliance and standardization of regulations : The childcare industry is subject to strict policy supervision. Smart childcare platforms need to ensure that their platform functions and service models meet local industry standards and regulatory requirements, especially when operating across countries or regions, they need to respond to compliance differences in different regions. (6) Scientific content and method : When designing the content and method of digital childcare service, it is necessary to ensure that it is based on the scientific theory of child development psychology and pedagogy, ensure the quality of service, and avoid relying too much on technology and ignoring the actual needs and healthy growth of infant development. (7) Market competition and technology optimization : With the increase of digital platforms, market competition intensifies. How to stand out in many platforms and win market trust and share requires strong marketing capabilities and differentiated service strategies. Moreover, the

digital technology iteration speed is fast, and the platform needs to be continuously updated to maintain competitiveness, which puts forward higher requirements for the response speed and innovation ability of the technical team.

5. Practical Strategies for Digital Empowerment to Improve the Quality and Efficiency of Infant Care Services

Based on the above challenges and dilemmas, this paper proposes the following practical strategies to promote digital empowerment to improve the quality and efficiency of infant care services:

- (1) Construction of diversified financing channels : the government should introduce a series of support policies, including the provision of financial subsidies to encourage the participation of social capital. Especially for small and medium-sized childcare institutions, the government can reduce their financial burden in the process of digital transformation through preferential measures such as low-interest loans and tax relief. In addition, the government should also advocate the public-private partnership (PPP) model to attract corporate investment and jointly promote the intelligent upgrading of the childcare industry.
- (2) Strengthen data security and privacy protection system : establish a strict data protection mechanism, using advanced encryption technology to ensure data transmission and storage security. Develop and implement a clear data privacy policy, conduct data protection training for employees, and enhance awareness of data leakage risk prevention. Third-party security audit is introduced to regularly check the security performance of the system to further strengthen data protection measures.
- (3) Systematization of user education and employee training : Develop user guides that are easy to understand and operate, and combine online and offline channels to conduct training courses. Particular attention needs to be paid to the training of parents and staff in order to increase their familiarity with and acceptance of the new system. At the same time, with the help of the government, industry associations and professional training institutions, free or low-cost training resources can be provided for small childcare institutions to ensure that they can successfully access and use the digital childcare platform.
- (4) Promote digital equity and narrow the gap : Governments and industry organizations should formulate targeted support plans, focus on the digital development of childcare institutions in rural and economically underdeveloped areas, and provide necessary technical assistance and financial support. Through these measures, we can promote the fair distribution of digital resources and ensure that all families can obtain high-quality childcare services.
- (5) Strengthen regulation compliance and standardization construction : In order to ensure the legal compliance of digital childcare services, we should actively intervene in the formulation and promotion of industry standards. At the same time, a cross-regional and cross-border legal advice and collaboration network is established to help the platform respond to the diversity of regulations in different regions. In addition, strengthen dialogue with regulators to ensure that business models adapt to the latest policy requirements in a timely manner.
- (6) Scientific guidance and content innovation : In order to ensure that the service content meets the physical and mental development needs of infants and young children, experts in the field of education and psychology should be invited to participate in the design of the platform content. At the same time, the service effect is evaluated regularly, and the content and methods are continuously optimized according to scientific research and practical feedback to prevent the abuse of technology and ensure the scientificity and effectiveness of the service.
- (7) Differentiated competition and continuous technological innovation: In-depth study of market demand, develop services and products with unique value propositions, such as

providing personalized growth plans, intelligent health monitoring and other functions. Through these differentiated service strategies, organizations can attract more users. At the same time, it is necessary to establish a R & D system that can quickly adapt to market and technological changes, and constantly update and innovate products, so as to enhance user experience and satisfaction and ensure a leading position in the competition.

Through the comprehensive implementation of the above strategies, we can effectively promote the digital transformation of the childcare service industry, promote the overall improvement of service quality and efficiency, narrow the digital divide and achieve fair development on the basis of ensuring data security, respecting user privacy and ensuring the scientific nature of services.

6. Conclusion and Foresight

Digital empowerment has become an important way to improve the quality and efficiency of infant care services. Through the integration of intelligent technology, big data analysis and cloud computing, the field of childcare has successfully broken through the limitations of traditional operations and entered a new era of intelligent safety monitoring, personalized health management, diversified educational materials and seamless home communication. This fundamental change not only strengthens the security line of service, improves the professional dimension, but also significantly increases the interactive participation and trust of parents, laying a solid foundation for the whole-person development of infants and young children. In the future, there are still many directions worth exploring in the digital transformation of infant care services, including deep integration and technological innovation, data security and privacy protection, policy support and industry norms, personnel training and professional development, international cooperation and experience sharing. In short, the digital transformation of infant care services is a continuous evolution process, which requires the joint efforts of policy, technology, education, society and other aspects to achieve a safer, more efficient, fair and high-quality infant care environment and promote the healthy growth of infants and young children.

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