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Research on Innovative Strategies for Empowering Kindergarten Curriculum and Instruction through Digital Technology

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Abstract: Against the backdrop of digital transformation in education, this study focuses on the strategies and approaches for integrating digital technologies into preschool curricula and teaching, addressing questions such as "How can technology innovate curriculum design, implementation, and evaluation?" The study examines the significance of its application, analyzes the existing issues in the digital technology-enabled preschool curricula and teaching, and proposes three major strategies: In curriculum design, use big data to precisely set goals, expand content with digital resource libraries, and support the development of school-based curricula with collaborative tools; in the organization and implementation of teaching, optimize scenarios with AR/VR, transform interaction with smart teaching aids, innovate methods with gamified apps, and explore the integration path of technology and games; in curriculum evaluation, advocate the use of process data for dynamic evaluation, provide personalized support through intelligent tools, and build a home-school collaboration platform. The research emphasizes that the implementation of strategies requires the establishment of a comprehensive support system for enhancing the quality of preschool teachers, configuring software and hardware, establishing ethical norms and health management, etc., to provide a systematic strategic framework for the digital transformation of kindergartens and conduct forward-looking analysis of practical challenges.

Keywords: Digital technology; Kindergarten curriculum; Teaching innovation; Empowerment strategies

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1. Introduction

The *Standards for Teachers' Digital Literacy*, promulgated in 2022, have established a benchmark framework for the development of teachers' digital capabilities, effectively promoting the integration of digital technology into curriculum education and teaching. We are living in a deeply digitalized era where cutting-edge technologies such as artificial intelligence, big data, and virtual reality have infiltrated educational settings, reshaping the methods, content, and ecosystem of teaching and learning. As the starting point of the national education system, the quality of curriculum and teaching in preschool education directly influences

the construction of early experiences and lifelong development potential in young children. Integrating digital technology into the curriculum and teaching system not only creates opportunities for teaching innovation but also poses new challenges. How to effectively utilize digital technology to drive curriculum innovation and reconstruct teaching paradigms in kindergartens has become a key area of exploration in the field of preschool education. Therefore, systematically exploring innovative strategies for empowering kindergarten curricula and teaching through digital technology holds significant practical importance and value for promoting the digital transformation and enhancing the quality of preschool education.

2. The application significance of digital technology in empowering kindergarten curriculum and teaching

2.1. Innovating teaching organization models

Delving into the application paths of digital technology in kindergarten curricula and teaching can drive early childhood educators to systematically optimize the organizational structure of curriculum activities with a digital teaching mindset. Research and practice on "how to teach" are unavoidable issues for every educator. Teachers can utilize interactive electronic whiteboards to innovate classroom interaction formats and meticulously create micro-lessons based on the characteristics and needs of children to meet personalized learning demands, achieving a comprehensive upgrade of teaching strategies, interaction models, and knowledge transmission methods. This injects innovative vitality into curriculum teaching and significantly enhances the learning experience of young children.

2.2. Optimizing curriculum teaching quality

Application strategies for digital technology in kindergarten curricula assist teachers in deeply exploring the value of technology empowerment. By addressing issues such as one-way indoctrination and monotonous teaching modes in traditional teaching, teachers are prompted to transform their teaching methods, precisely locate teaching objectives, enhance the efficiency of curriculum educational activities, and ensure the effective achievement of teaching outcomes [1]. This teaching innovation not only optimizes the current classroom ecosystem but also lays the foundation for children's ability to explore independently and engage in lifelong learning through enjoyable and diverse interactive learning experiences, aligning with the core goal of preschool education to cultivate future innovative talents.

2.3. Promoting children's holistic development

Systematic research on the application methods of digital technology can drive early childhood educators to update their educational philosophies and establish a teaching orientation centered on children's development. Relying on the advantages of digital technology, respecting individual learning characteristics, cultivating diverse abilities and comprehensive qualities, and effectively implementing the requirements of quality education can enrich children's activity experiences, enhance their learning interests, and assist them in achieving sustained growth and development. This development is not limited to immediate cognitive and ability enhancement but also lays a solid foundation for them to adapt to the future digital society and grow into innovative talents with core competitiveness. Meanwhile, the internet can break through spatial and temporal limitations, allowing children to embark on exploration journeys anytime and anywhere, unleashing boundless creativity.

3. Problem analysis of digital technology empowering kindergarten curriculum and teaching

3.1. Shortcomings in teachers' information application capabilities

The rapid iteration of digital technology requires teachers to continuously update their knowledge systems and integrate informational elements into daily teaching. However, in practice, some older teachers or those less sensitive to new technologies find it difficult to master digital technology proficiently and integrate it into the kindergarten curriculum system, to a certain extent, constraining the advancement of curriculum reform and teaching mode innovation. This not only results in monotonous teaching activity formats and insufficient interactivity in some classes, making it difficult to stimulate children's interests and potentials, and affecting the balanced improvement of teaching quality, but also makes it difficult for kindergartens to fully implement advanced educational philosophies in the process of technology-empowered education, creating a gap between ideals and practice [2].

3.2. Inadequate adaptation of technology application to learning characteristics

Young children have short attention spans, and if classroom teaching fails to effectively stimulate their learning interests, it can easily lead to boredom and reduced participation. Some kindergartens, when applying digital technology, exhibit a disconnect between technological functions and teaching objectives, failing to fully integrate teaching scenarios with children's life experiences, resulting in poor understanding and mastery of knowledge by children, deviating from the original intent of technology application. The root cause lies in the excessive pursuit of the "novelty" and "flashiness" of technology in some applications, neglecting whether it truly serves specific teaching objectives and aligns with the cognitive levels and interests of children in this age group. The core contradiction is that the design logic of technology application fails to effectively integrate with the concrete and experiential learning characteristics of children, preventing technological advantages from being converted into learning efficacy.

3.3. Lack of collaborative mechanisms for home-kindergarten co-education

The core goal of applying digital technology is to enhance teaching quality and promote the holistic development of children, with family education being a crucial link in this process. Currently, most parents lag behind in educational philosophies and lack necessary skills. Coupled with limited communication channels and untimely information sharing between home and kindergarten, teachers find it difficult to grasp children's performance at home, and parents lack a deep understanding of kindergarten education. Although the concept of home-kindergarten co-education is widely promoted, the lack of digital collaborative mechanisms makes it difficult to fully realize the co-education effect, affecting the continuity and integrity of children's growth.

4. Innovative strategies for digital technology empowering kindergarten curriculum and teaching

The core of achieving deep integration of information technology with kindergarten curricula lies in constructing an integrated system that combines the two. Information technology should fully penetrate all aspects of curriculum and teaching, becoming an important auxiliary means for teachers to implement teaching activities and even more so, a key tool for children to perceive the world. Information technology

should deeply participate in the innovation of teaching material forms; in teaching practice, it should serve as a dominant medium throughout, thereby achieving organic unity between technology, education, and teaching.

4.1. Digital technology empowering kindergarten curriculum development

4.1.1. Data-driven: Precisely locating curriculum objectives

Utilize big data to collect and analyze regional norms for child development, historical data from the kindergarten (such as assessment results in the five developmental areas of health, language, society, etc.), and community and family background information. Through analysis, teachers can more clearly identify the common needs and developmental potential baselines of child groups, as well as differentiated characteristics brought about by different backgrounds. Combine the results of big data analysis with the objectives outlined in the *Guidelines for the Learning and Development of Children Aged 3–6* and the kindergarten's educational philosophy to form a more precise, dynamic, and personalized curriculum objective system at the kindergarten, grade, and class levels, avoiding ambiguity in objectives.

4.1.2. Cloud empowerment: Expanding curriculum content creation

Leverage national and provincial public service platforms for early childhood education resources, high-quality open-source project libraries from early childhood education institutions, and digital library resources from authoritative domestic and international sources for young children. Teachers can efficiently search for cutting-edge curriculum concept cases, rich thematic material packages, multicultural background stories, scientific inquiry project recordings, etc. [3]. This expands the breadth and depth of content selection, breaks through geographical limitations, and even more so, inspires teachers' creative inspiration. Through screening, reorganizing, and localizing high-quality resources, teachers can efficiently generate curriculum content that is more in line with the actual conditions of their kindergarten, has deeper cultural roots, and is more in tune with the times. In this regard, it is necessary for teachers to create high-quality online courses for young children, bringing new opportunities and possibilities to early childhood education.

4.1.3. Collaborative design: Activating kindergarten-based curriculum development

Utilize cloud-based collaborative design and development tools to construct a collaborative space for curriculum development. Support collaboration among teachers within the kindergarten, across different kindergartens, or with educational researchers and university experts to jointly edit and modify curriculum plans online, share feedback, and manage versions. In the kindergarten-based curriculum development process, technology enhances the transparency of the process, collaboration efficiency, and the standardization of outcomes. Meanwhile, teachers should actively select the most suitable learning materials based on children's characteristics and learning needs, exposing them to broader knowledge domains, thereby facilitating the convenient iteration and generation of kindergarten-based curricula that better reflect the kindergarten's characteristics.

4.2. Digital technology empowering kindergarten curriculum organization and implementation

4.2.1. Scenario creation: Blending virtual and real to optimize the environment

Utilize AR technology, such as scanning physical cards or picture books with tablets to overlay dynamic

3D models and interactive games on the screen; use simple VR devices to lead children to "immerse" themselves in environments they cannot physically visit, enhancing the intuitiveness and exploratory fun of thematic teaching [4]. IoT sensors monitor classroom temperature, humidity, light, and air quality in real-time, transmitting data wirelessly to a control center. Based on preset comfort ranges for children, the system automatically adjusts or prompts teachers to adjust air conditioning, sunshades, and other equipment, creating a more comfortable and healthy learning environment.

4.2.2. Interaction modes: Human-machine collaboration with multidimensional feedback

Through programmable educational robots, interactive floor projection systems, etc., set specific task scenarios to make the machine system a "playmate," "demonstrator," or "task issuer." This human-machine interaction provides immediate, consistent, and objective feedback, reducing teachers' repetitive guidance burden and allowing them to focus on emotional support and guiding higher-order thinking. In regional activities, use tablet apps to record children's operational processes and brief observations. When reviewing or communicating individually with children, teachers can utilize these records to revisit the learning process and provide targeted guidance. The app can offer personalized suggestions or push interest-related extension resources to the home-kindergarten platform to support family extension.

4.2.3. Teaching methods: Game-based learning with progressive inquiry

Design game-based learning apps that cleverly embed learning objectives into fun scenarios. Game mechanics effectively maintain children's motivation, while individual progress differences are automatically recorded and adapted. This digital gaming is an extension of traditional tabletop games and should be complemented by outdoor large-motor games, social role-playing games, etc. When conducting project-based learning, digital tools provide strong support. Children use tablets to photograph observed phenomena, use simple drawing software to collaboratively create design drawings, search for relevant information online, and use simple video editing software to create outcome presentation reports or story records to document the inquiry process. Teachers can guide children to cultivate core competencies through drawing-based game construction, enhancing the breadth and depth of classroom knowledge and providing feasible paths for kindergarten teachers to handle complex problems and stimulate children's thinking.

4.3. Digital technology empowering kindergarten curriculum evaluation

4.3.1. Data-driven process evaluation: Objective, multidimensional, and real-time capture

Use tablet devices to record videos and audio at appropriate times; utilize smart teaching aids equipped with sensors to record children's operational frequency, duration, accuracy rate, collaboration situation, etc.; allow children to create and upload digital works to personal growth archives using drawing or audio recording functions. Emphasize the combination of children's self-evaluation, teacher evaluation, and information technology means in curriculum practice activities to mobilize children's enthusiasm for activities and promote their holistic development. Teachers emphasize the paradigm shift from "outcome assessment to process support" through video replay [5]. Supplemented by teachers' brief written observation records, this can comprehensively and objectively showcase children's developmental trajectories, strengths and challenges, learning styles, and interests across different domains and time points.

4.3.2. Intelligent diagnosis and support: Precise analysis and personalized plans

Utilize platform functions to visually present children's multiple performances in specific areas through trend graphs, ability radar charts, etc. Use simple algorithms to analyze children's speech to identify vocabulary richness and sentence complexity; analyze photos of block constructions to identify features such as symmetry. The algorithm's ability to co-generate content with users demonstrates strong interactivity and adaptability. Compare the analysis results with children's developmental stage indicators to provide clues for teachers to identify developmental milestones and special needs. Based on data and AI-assisted analysis, the platform can intelligently recommend activity suggestions, resources, or adjustment strategies that match children's current developmental levels and interests, providing a strong basis for teachers to customize personalized support.

4.3.3. Transparent home-kindergarten co-education platform: Enhancing understanding and promoting joint development

Use a home-kindergarten co-education platform or kindergarten official account specifically designed for kindergartens to selectively push highlights of children's learning moments, work achievement screenshots, and non-sensitive evaluations to parents. The platform provides a convenient and private communication channel between home and kindergarten, allowing parents to upload children's performance at home, inquire about situations with teachers, and provide family background information at any time. This greatly enhances the transparency of the evaluation process, parents' sense of participation, and their continuous understanding of children's development, forming a virtuous evaluation loop for home-kindergarten collaboration.

5. Guarantee system for empowering kindergarten curriculum and teaching with digital technology

5.1. Enhancement of teachers' digital literacy

There is relatively little research on the scientific, comprehensive, and in-depth evaluation of kindergarten teachers' digital literacy, so it is essential to enhance teachers' digital literacy. Set goals based on the existing proficiency levels of kindergarten teachers to avoid a one-size-fits-all approach. Combine practical workshops, such as designing activities with AR technology and analyzing simple data charts, with micro-research projects based on real teaching needs, emphasizing practical reflection and the transformation of results. Establish a collaborative teaching and research community that combines online and offline interactions, encouraging the exchange of experiences, resource sharing, and mutual assistance. Continuously track the development trends of teachers' digital literacy and promptly adjust and optimize training strategies.

5.2. Optimization of hardware and software resource allocation

Equipment procurement should prioritize meeting the needs of core teaching activities, such as individualized learning support, scenario creation, and process recording, rather than pursuing cutting-edge, high-end configurations. Ensure reliable network connectivity and adequate storage space. Encourage the establishment and sharing of localized digital educational resource libraries within kindergartens and regions that have undergone quality screening and clear categorization to avoid resource wastage. Kindergartens need to regularly update the content of these resource libraries, promptly introducing the latest and educationally valuable resources while eliminating outdated or low-quality ones. Establish a feedback mechanism for the

use of resource libraries to collect experiences and suggestions from teachers and children, continuously optimizing and improving the functionality and content of the resource libraries to better align with teaching practices and meet children's learning needs.

5.3. Ethical guidelines and health management

Develop usage agreements with clear and concise rules jointly established by teachers and students, covering aspects such as the duration of each use, appropriate activity content, and interaction etiquette, integrating technology use into regular classroom management. Designate specific areas or time slots as screen-free periods, emphasizing the importance of hands-on activities, interpersonal interactions, and quiet reading. Utilize built-in management tools on devices or a unified kindergarten-level management platform to strictly control the cumulative daily usage time of individual children on tablets, projection teaching systems, etc., to prevent excessive exposure.

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