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Artificial Intelligence for Enhancing Nutrition Education in Early Childhood

Nafeela S

Department of Home Science with Food Biotechnology, Fatima College (autonomous), India

Corresponding author: ***nafeela093@gmail.com***

Abstract

Early childhood is a critical phase for the development of dietary habits and long-term health outcomes. During this stage, children are highly impressionable, and their food preferences and eating behaviours are strongly influenced by their immediate environment, including family, school, and media exposure. Establishing healthy nutritional practices at this age is essential for preventing future health complications and promoting overall well-being. This study focuses on understanding the role of school-based nutrition education interventions in shaping the knowledge, attitudes, and practices of young children. A comprehensive review of existing literature was conducted, analyzing studies on classroom-based teaching methods, activity-based learning, and parental involvement programs. The collected data from various research articles were systematically examined to identify patterns and outcomes associated with these interventions. Recent advancements in artificial intelligence have also been considered, particularly the use of AI-based educational applications, interactive learning platforms, and personalized content delivery systems that enhance engagement among young learners. The findings indicate that structured nutrition education significantly improves children's awareness and promotes healthier food choices, especially when combined with family participation and technology-supported learning. However, challenges such as limited resources, inadequate teacher training, and external influences like media and food marketing persist. In conclusion, integrating innovative teaching strategies, including artificial intelligence, can strengthen early childhood nutrition education and contribute to the development of sustainable healthy habits and improved public health outcomes.

Keywords: Artificial Intelligence, AI-based educational applications, Early childhood, Nutrition Education, School-based educational interventions.

Introduction

Early childhood is a crucial stage of development, during which foundational habits related to health, behavior, and learning are established. Nutritional practices formed during these early years play a significant role in influencing long-term health outcomes, including physical growth, cognitive development, and prevention of chronic diseases. In recent years, increasing concerns regarding unhealthy dietary patterns among children have highlighted the need for more effective and engaging approaches to nutrition education at an early age.

Traditional methods of nutrition education, such as classroom instruction and activity-based learning, have been successful in improving awareness among children. However, these approaches often lack personalization and sustained engagement, thereby limiting their overall effectiveness. With the rapid advancement of digital technologies, educational practices are evolving to incorporate more interactive and learner-centered strategies in the classroom.

Artificial intelligence (AI) has emerged as a transformative tool in education, enabling the development of adaptive and personalized learning environments. AI-driven applications, mobile platforms, and gamified systems allow educational content to be tailored to individual learning needs, thereby enhancing engagement and knowledge retention. In particular, the integration of AI with gamification and immersive technologies has shown potential in making nutrition education more interactive and appealing for young learners.
Despite these advancements, the application of AI in early childhood nutrition education remains relatively underexplored. Existing studies primarily focus on general digital learning tools, with limited emphasis on the specific role of AI in shaping nutritional knowledge and behaviour among young children. Therefore, this study aims to systematically review the existing literature on the role of artificial intelligence in early childhood nutrition education, focusing on the types of AI-based interventions, their effectiveness, and their impact on learning outcomes, while also identifying key research gaps in this emerging field.

Review of Related Literature

This section critically examines the existing research on the application of artificial intelligence (AI) in early childhood nutrition education. It focuses on the types of technologies used, their educational applications, observed outcomes, and the limitations identified in the studies.

AI Technologies in Early Childhood Education

Studies indicate that AI technologies such as adaptive learning systems, intelligent tutoring platforms, and gamified applications are increasingly being integrated into early childhood education (Rosati et al., 2025; Oshinowo et al., 2025). These technologies enable personalized learning experiences by adjusting content according to individual progress and performance, which has been associated with improved engagement and enhanced knowledge retention among young learners.

Applications of AI in Nutrition Education

Research suggests that AI-driven tools, particularly gamified platforms and augmented reality applications, are effective in simplifying complex nutritional concepts for the target audience (Rosati et al., 2025; Capecchi et al., 2025). By presenting content through interactive and visually engaging formats, these technologies improve comprehension and encourage positive learning experiences related to nutrition among children.

Impact of AI-Driven Interventions on Child Nutrition Outcomes

Existing studies have reported that AI-based interventions contribute to increased motivation, higher engagement levels, and improved knowledge acquisition (Hedaoo & Vali, 2015; Rosati et al., 2025). However, most findings are based on short-term evaluations, and there is limited evidence regarding the long-term impact of these interventions on sustained dietary behaviours and overall health outcomes.

Challenges and Limitations in Existing Research

The literature also highlights several challenges, including unequal access to digital resources, differences in digital literacy, and the limited availability of age-appropriate AI-based content. Additionally, concerns related to data privacy, ethical considerations, and excessive screen exposure have been identified as barriers to the effective implementation of AI in early childhood settings (Oshinowo et al., 2025).

Critical Analysis

A critical review of the studies reveals that, although AI demonstrates strong potential in enhancing nutrition education, current research remains fragmented and often limited in scale. The absence of standardized methodologies and long-term studies restricts the ability to draw definitive conclusions regarding the effectiveness and scalability of AI-driven approaches.

Relevance to the Present Study

Overall, the study highlights both the opportunities and limitations associated with AI in early childhood nutrition education. These findings underscore the need for more comprehensive and systematic research, which this study aims to address by analyzing existing evidence to better understand the role and future potential of AI in this field.

Objectives

The primary objective of this study is to examine the role of artificial intelligence (AI) in enhancing early childhood nutrition education, with a focus on improving learning outcomes, engagement, and healthy behavioral development among young children. The study aims to explore how emerging technologies can be effectively integrated into educational practices to address current limitations in traditional nutrition education methods.

The specific objectives of the study are:

- To analyze the different types of artificial intelligence technologies utilized in early childhood education, particularly those applied in the context of nutrition learning and health education.
- To examine the application of AI-driven tools, including gamified platforms, interactive applications, and adaptive learning systems, in delivering nutrition-related content to young children in an engaging and accessible manner.
- To evaluate the effectiveness of AI-based interventions in enhancing children’s knowledge, improving engagement levels, and influencing positive nutritional behaviors.
- To identify and critically assess the key challenges, limitations, and ethical concerns associated with the use of AI in early childhood nutrition education, including issues related to accessibility, digital literacy, and data privacy.
- To explore existing gaps in the current body of research and highlight areas that require further investigation, particularly with respect to long-term impacts and large-scale implementation of AI-based educational strategies.
- To provide insights and recommendations for the effective integration of AI technologies in early childhood nutrition education, with the aim of supporting the development of more personalized, interactive, and sustainable learning approaches.

Methodology

This literature review systematically examines existing research on the application of artificial intelligence (AI) in early childhood nutrition education. The review process involved the following steps:

Literature Search Strategy

A comprehensive search was conducted across multiple academic databases, including Google Scholar, PubMed, and Science Direct, along with peer-reviewed journals, conference proceedings, and relevant gray literature. Keywords and phrases such as "artificial intelligence," "early childhood," "nutrition education," "AI in education," and related terms were used to identify pertinent studies published between 2014 and 2025. Inclusion criteria focused on studies involving AI technologies applied to nutrition education for children aged 3 to 6 years.

Selection and Screening

Identified records were screened through a two-stage process: initial title and abstract review followed by full-text assessment. Studies were included if they addressed AI-driven interventions, educational tools, or frameworks targeting nutrition knowledge or behavior in early childhood settings. Exclusion criteria eliminated studies not directly related to AI or nutrition education within the specified age group. A total of 8 studies meeting the inclusion criteria were selected for final analysis.

Quality Assessment

Quality assessment criteria, including study design, sample size considerations, and methodological rigor, were applied to ensure robustness and validity of the included studies.

Data Extraction and Synthesis

Key information was extracted from selected studies, including AI methodologies employed (e.g., machine learning, natural language processing), educational approaches, types of nutrition content delivered, and reported outcomes. The extracted data were systematically organized into thematic categories to identify common patterns, technological trends, pedagogical strategies, and gaps in current research.

Critical Analysis

The review critically evaluated the effectiveness, usability, and engagement aspects of AI applications in early childhood nutrition education. Methodological quality and limitations of the included studies were also assessed to contextualize findings and inform recommendations for future research.

This structured methodology ensures a comprehensive understanding of the current landscape of AI in early childhood nutrition education, highlighting both advancements and areas requiring further exploration.

Analysis

The selected literature was organized into six major themes based on technological integration, educational methodology, behavioural outcomes, and the application of AI in early childhood nutrition education. These themes include:

(a) AI-powered nutrition education platforms

(b) gamification and game-based learning
(c) AI integration in cognitive development
(d) augmented reality and multimedia technologies
(e) inclusivity and accessibility
(f) sustainability and future directions.

Across the reviewed studies, measurable improvements were observed in learner engagement, cognitive development, nutritional awareness, food preference behaviour, instructional efficiency, and emotional participation following AI-supported interventions. The findings demonstrate that artificial intelligence is transforming nutrition education from passive content delivery into an interactive, adaptive, and behaviour-oriented learning process suited to early childhood environments.

AI-Powered Nutrition Education Platforms

AI-powered nutrition education platforms represent a significant advancement in educational technology. These systems integrate adaptive learning, predictive analytics, intelligent monitoring, and personalized feedback to enhance children's learning experiences (Oshinowo et al., 2025). Research indicates that AI systems can tailor nutritional guidance based on age, dietary behaviour, cognitive ability, learning pace, and behavioural responses. This level of personalization improves engagement by replacing static instruction with dynamic, real-time interaction. Empirical findings further support this impact. For instance, studies reported a 74% improvement in learner engagement and a 19% increase in attention span, indicating that AI-supported environments promote sustained focus and active participation. Additionally, cognitive outcomes improved significantly, with 68% enhancement in learning performance, alongside increases in literacy (22%) and numeracy skills (17%). These results suggest that AI not only supports nutrition education but also contributes to overall developmental learning. Teacher efficiency also improved, with a 31% reduction in routine tasks and 67% improvement in lesson planning efficiency, highlighting the dual benefit of AI in both teaching and learning processes (Oshinowo et al., 2025). However, challenges persist. A notable 42% of educators reported insufficient AI training, indicating that successful implementation depends heavily on professional development and institutional support. Furthermore, issues related to scalability, infrastructure, and long-term behavioural impact remain key research gaps.

Gamification and Game-Based Learning in Nutrition Education

Gamification emerged as a highly effective approach for enhancing engagement and motivation in nutrition education. Game-based learning environments incorporate reward systems, interactive challenges, and feedback mechanisms that encourage active participation. Studies consistently demonstrate that gamified interventions lead to higher levels of engagement and improved nutritional awareness compared to traditional teaching methods. The integration of behavioural tracking and adaptive challenges further enhances personalization and sustained interest. For example, increased attention levels observed in gamified systems (up to 19%) indicate that interactive elements significantly improve focus and participation (Rosati et al., 2025). Additionally, gamification supports emotional engagement and knowledge retention by combining entertainment with educational objectives.

Despite these strengths, limitations remain. Most studies were conducted over short durations with small sample sizes, making it difficult to assess long-term behavioural

change. Furthermore, variations in evaluation methods—ranging from engagement metrics to behavioural outcomes—limit direct comparison across studies.

AI Integration in Early Childhood and Cognitive Development

AI-supported multimedia learning plays a crucial role in enhancing cognitive development during early childhood. The reviewed studies demonstrate substantial improvements in both knowledge acquisition and behavioural outcomes. One intervention reported an increase in correct responses from 38.79% to 75.89%, indicating a significant improvement in nutrition knowledge. Similarly, behavioural changes were evident, with preference for healthy food increasing from 40% to 97%, while unhealthy food preference decreased dramatically (Hedaoo & Vali, 2015). These findings suggest that AI-supported instruction can effectively influence both understanding and behaviour. The statistical significance of these results further confirms the strong relationship between multimedia-based learning and improved outcomes. Such evidence highlights the effectiveness of multisensory and interactive learning environments in early childhood education. However, the literature also identifies limitations related to long-term developmental impact, accessibility for children with learning disabilities, and socioeconomic disparities affecting technology adoption (Hedaoo & Vali, 2015).

Augmented Reality and Multimedia Technologies for Nutrition and Sustainability

Augmented Reality (AR) and multimedia technologies enhance experiential learning by enabling interactive visualization of abstract concepts such as nutrient composition and sustainable food practices. Unlike traditional instructional methods, AR creates immersive learning environments that improve conceptual understanding and engagement. Multimedia tools—including animations, storytelling, and interactive quizzes—further support cognitive and emotional learning processes. These technologies also contribute to sustainability education by promoting awareness of food waste reduction, ecological responsibility, and healthy consumption patterns. Despite these benefits, high implementation costs, infrastructure requirements, and limited teacher training remain significant barriers to large-scale adoption (Capecchi et al., 2025).

Inclusivity, Accessibility, and Educational Equity

Inclusivity and accessibility are critical considerations in AI-based education. The reviewed literature highlights the potential of AI systems to support diverse learners through personalized instruction, adaptive content, and assistive technologies such as voice and gesture recognition. For instance, 71% of participants supported AI-based inclusive interventions, indicating strong acceptance of technology-assisted learning for children with disabilities. These systems reduce cognitive overload and accommodate different learning styles, thereby improving accessibility.

However, significant challenges remain. Educational inequality persists due to uneven access to technology, and 42% of educators reported inadequate training, limiting effective implementation. These findings suggest that without institutional investment and policy support, AI may unintentionally widen existing educational disparities (Oshinowo et al., 2025).

Sustainability and Future Directions in AI-Based Nutrition Education

Sustainability emerged as a key future-oriented theme. AI-supported systems have the potential to integrate environmental awareness with nutrition education through interactive simulations, personalized recommendations, and behavioural tracking.

However, current research is limited by short study durations and small sample sizes. Most studies focus on immediate learning outcomes rather than long-term behavioural or health impacts. These limitations highlight the need for longitudinal research, standardized evaluation methods, and larger participant groups. Future studies should also address ethical considerations, screen-time balance, and sustainable classroom integration.

Cross-Theme Analysis

A cross-theme synthesis reveals strong interconnections between personalization, gamification, cognitive development, multimedia engagement, inclusivity, and sustainability. Across all themes, consistent patterns include adaptive learning, interactive participation, behavioural reinforcement, and child-centered instructional design. The reviewed studies demonstrate measurable improvements, including increased attention, enhanced literacy and numeracy skills, and significant gains in nutritional awareness. These outcomes indicate that AI-supported interventions are more effective than traditional methods in promoting both engagement and learning. Furthermore, the literature highlights strong interdisciplinary integration between artificial intelligence, educational technology, developmental psychology, behavioural science, and nutrition science. This convergence is essential for developing holistic and effective educational systems. Overall, the findings suggest that AI-driven nutrition education is most effective when multiple approaches—such as personalization, gamification, and multimedia engagement—are combined within a unified framework. This emphasizes the importance of designing integrated, child-centered learning environments rather than relying on isolated technological solutions.

Findings and Discussion

Strengths and Limitations

The reviewed literature demonstrates several strengths in the application of Artificial Intelligence in early childhood nutrition education, particularly using innovative and interactive technologies such as adaptive learning systems, gamification, multimedia tools, and augmented reality, which significantly enhance learner engagement and participation. A key strength is the interdisciplinary integration of artificial intelligence with developmental psychology, educational technology, and nutrition science, enabling the creation of effective, child-centered learning environments. Additionally, multiple studies provide empirical evidence of positive outcomes, including improvements in nutritional awareness, cognitive development, attention span, and food-related behaviours, often supported by measurable pre- and post-intervention data. The potential for personalized and inclusive learning further highlights the adaptability of AI in addressing diverse learner needs. However, despite these strengths, several limitations are evident. Many studies rely on small sample sizes and controlled settings, limiting the generalizability of findings to real-world contexts. The short duration of most interventions restricts the assessment of long-term behavioural sustainability, while inconsistencies in evaluation methods make cross-study comparisons challenging. Furthermore, issues related to accessibility, including technological infrastructure, cost, and insufficient teacher training, pose significant barriers to implementation. There is also a lack of large-scale and longitudinal research, along with limited exploration of ethical concerns such as data privacy, screen time, and long-term psychological effects, indicating important areas for future investigation.

Table 1. Classification of AI based educational approaches in nutrition learning

Theme	**Technology used**	**Key features**	**Outcomes observed**	**Limitations**
AI-Powered Platforms	Adaptive learning systems, AI tutoring	Personalization, real time feedback, predictive analytics	Improved engagement, individualized learning, better comprehension	High cost, limited scalability, need for teacher training
Gamification	Game based learning, reward systems	Interactive challenges, motivation, feedback loops	Increased participation, improved retention, enhanced engagement	Short-term studies, small sample sizes
Cognitive & multimedia learning	Multimedia tools, AI supported instructions	Visual learning, Animations, quizzes, multisensory approach	Improved knowledge, better food behaviour, higher recall	Limited long-term evaluation
AR & Multimedia technologies	Augmented reality, interactive media	Immersive visualization and experiential learning	Better conceptual understanding, sustainability awareness	Infrastructure dependency, high implementation cost
Inclusivity and accessibility	AI adaptive systems, assistive technologies	Voice/gesture support	Improved inclusive learning, support for diverse needs	Digital divide, lack of access, insufficient training
Sustainability & future directions	AI + AR integration	Behaviour tracking, sustainability education	Awareness of sustainable diets, long-term potential	Lack of longitudinal studies, ethical concerns

The reviewed literature demonstrates that Artificial Intelligence (AI)-based educational technologies significantly improve nutrition awareness, learner engagement, cognitive development, and behavioural outcomes among children. Across the selected studies, AI-supported systems—including gamification, multimedia learning, adaptive platforms, and augmented reality—consistently produced measurable educational and behavioural improvements. The findings highlight that AI integration transforms nutrition education from passive information delivery into an interactive, personalized, and behaviour-oriented learning experience suitable for early childhood environments.

Improvement in Nutritional Knowledge and Awareness

One of the most consistent findings across the reviewed studies is the significant improvement in nutrition-related knowledge following AI-supported or multimedia-based interventions. A study involving 100 students aged 10–12 years reported that mean correct responses increased from 38.79% to 75.89%, while incorrect responses decreased from 61.21% to 24.11% after a 15-day intervention. This substantial shift indicates a marked improvement in children's comprehension and retention of nutritional concepts. Specific knowledge gains further support this trend. Balanced diet awareness improved from 45% to 72%, while understanding of ideal meal frequency increased from 3% to 65%, demonstrating enhanced foundational knowledge. Similarly, food pyramid awareness rose from 0% to 65%, and protein-related knowledge increased from 10% to 88%, indicating strong conceptual development. Awareness of the role of vitamins and minerals in preventing infections also improved significantly from 22% to 84%, reflecting improved health literacy (Hedaoo & Vali, 2015). These findings collectively demonstrate that AI-supported and multimedia-based educational approaches significantly enhance children's understanding of nutrition and healthy eating practices.

Behavioural Changes in Food Preferences

The reviewed literature also demonstrates that AI-supported interventions influence children's dietary behaviour and food preferences. Following the intervention, preference for homemade food increased from 40% to 97%, while preference for junk food decreased from 60% to 3%. This dramatic behavioural shift indicates that educational interventions can translate knowledge into practical lifestyle changes. Statistical analysis confirms a highly significant relationship between multimedia-based nutrition education and behavioural improvement. This suggests that AI-supported learning environments are effective not only in improving knowledge but also in shaping long-term dietary behaviour.

Enhancement of Cognitive Development and Learning Performance

Several studies reported measurable improvements in cognitive development and learning performance following AI-supported interventions. Results indicate a 68% improvement in cognitive development, along with a 22% increase in literacy skills and a 17% improvement in numeracy and pattern recognition abilities. These outcomes suggest that AI-supported systems enhance not only subject-specific knowledge but also overall cognitive functioning. Additionally, learner attention span increased by 19%, while 74% of respondents reported improved engagement, indicating that AI-based learning environments promote sustained focus and active participation (Oshinowo et al., 2025). These findings demonstrate that AI-supported educational tools contribute to multisensory engagement and developmental learning, which are critical during early childhood.

Increased Learner Engagement Through Gamification

Evidence from the selected articles show gamification as a highly effective approach for enhancing learner engagement and motivation. Gamified learning environments, incorporating reward systems, interactive tasks, and adaptive challenges, resulted in increased participation and improved retention of nutrition-related concepts. Observations from game-based studies indicate improved attention, reduced boredom, and enhanced emotional engagement during learning activities. This suggests that gamification is not only an engagement tool but also a mechanism for reinforcing behavioural learning through interactive feedback and reward-based motivation. However, most studies were conducted over short durations with small sample sizes, limiting the ability to assess long-term behavioural sustainability.

Improvement in Teacher Efficiency and Educational Management

AI integration also demonstrated measurable benefits for educators and classroom management. Studies reported a 31% reduction in routine assessment tasks and a 67% improvement in lesson planning efficiency, resulting in an overall 24% increase in instructional effectiveness. These improvements indicate that AI can streamline administrative tasks, allowing educators to focus more on teaching and student interaction. This highlights the dual advantage of AI in enhancing both learning outcomes and educational efficiency.

Inclusivity and Accessibility Findings

The literature highlights the potential of AI to support inclusive education through adaptive and assistive technologies. Approximately 71% of participants supported AI-assisted inclusive learning systems, particularly those incorporating voice recognition and gesture-based interaction. These technologies help accommodate diverse learning needs and reduce cognitive barriers. However, challenges remain significant. Around 42% of educators reported insufficient AI training, which limits effective classroom implementation. Additionally, unequal access to technological resources may contribute to widening educational disparities. These findings suggest that while AI has strong inclusive potential, its success depends on infrastructure, training, and policy support.

Findings Related to Augmented Reality and Multimedia Learning

Augmented Reality (AR) and multimedia technologies enhance experiential and visual learning in nutrition education. Studies indicate that AR-supported systems improve conceptual understanding by enabling interactive visualization of nutritional content. Multimedia tools, including animations, storytelling, and interactive quizzes, further enhance engagement and retention. These findings suggest that multisensory learning environments are particularly effective for young learners, as they align with developmental learning patterns and improve both cognitive and emotional engagement.

Table 2. Comparative analysis of pre – and post – intervention outcomes

Measured Outcomes	**Pre – intervention**	**Post – intervention**	**Outcome improvement**
Correct nutrition knowledge responses	38.79%	75.89%	+37.10% increase
Awareness of balanced diet	45%	72%	+27% increase
Knowledge of ideal meals per day	3%	65%	+62% increase
Food pyramid awareness	0%	65%	+65% increase
Knowledge about proteins for growth	10%	88%	+78% increase
Awareness on vitamins and minerals that prevent infections	22%	84%	+62% increase
Preference for homemade food	40%	97%	+57% increase

Preference for junk food	60%	3%	-57% decrease
Learner attention span after AI-supported learning	Traditional baseline	AI driven learning	+19% increase
Learner engagement in AI/gamified environments	Traditional instructions	Gamified AI instructions	Significantly higher participation and motivation

Overall Findings

The overall findings demonstrate that technology enhanced nutrition education systems positively influence:

- Nutritional awareness
- Cognitive development
- Learner engagement
- Behavioural reinforcement
- Food preference behaviour
- Instructional efficiency

Key measurable outcomes include:

Increase in correct responses from 38.79% to 75.89%, indicating improved knowledge. Increase in healthy food preference from 40% to 97%, reflecting behavioural change. Reduction in unhealthy food preference from 60% to 3%, showing lifestyle impact 22% improvement in literacy and 17% in numeracy, indicating cognitive benefits. 19% increase in attention span, reflecting enhanced engagement. Despite these positive outcomes, limitations such as small sample sizes, short intervention durations, lack of longitudinal evidence, and insufficient teacher training remain significant challenges.

Overall, the findings demonstrate that AI-driven nutrition education is most effective when cognitive, behavioural, and interactive learning strategies are integrated within a unified system, rather than implemented as isolated technological interventions.

Educational Implications

The study highlights the value of incorporating modern digital tools into nutrition education to create more engaging and learner-friendly classroom experiences that encourage healthy lifestyle habits from an early age.

Implications for Teachers and Educational Management

Technology-assisted instruction can support educators by simplifying classroom management, improving instructional planning, and enabling more individualized learning experiences. Effective implementation, however, depends on proper training and institutional encouragement.

Implications for Child Health and Nutrition

Interactive educational approaches can contribute to better food choices, improved health awareness, and stronger understanding of balanced dietary practices among children.

Technological and Policy Implications

Successful integration of digital learning systems requires improved infrastructure, equitable access to technology, supportive educational policies, and ethical guidelines that ensure safe and inclusive usage.

Research Implications

Further investigations are needed to examine long-term educational and behavioural outcomes, larger population groups, and the practical challenges associated with integrating emerging technologies into early childhood learning environments.

Conclusion

This review underscores the expanding role of Artificial Intelligence (AI) in enhancing nutrition education during early childhood through innovative, child-centered approaches. Technologies such as adaptive learning applications, digital games, multimedia resources, and augmented reality have demonstrated significant potential in improving children's understanding of healthy eating while making learning more engaging and enjoyable. Compared to traditional methods, AI-assisted instruction offers a flexible and personalized learning experience aligned with young learners' developmental needs.

The findings reveal that technology-enhanced education supports broader developmental outcomes by fostering curiosity, participation, concentration, and experiential learning. Interactive activities, visual materials, and personalized feedback create stimulating environments that promote both conceptual understanding and positive habit formation. The interdisciplinary integration of educational technology, behavioral science, developmental psychology, and nutrition science provides a robust foundation for designing effective learning experiences.

Despite these advantages, barriers such as limited access to digital resources, high infrastructure costs, insufficient professional training, and unequal technological availability persist. Addressing these challenges requires focused efforts on professional development, equitable infrastructure investment, and supportive policies to ensure inclusive implementation. The absence of extensive long-term studies complicates the assessment of sustained impacts on dietary behaviours and overall well-being. Ethical considerations regarding responsible technology use, data privacy, and balanced screen exposure also warrant greater attention and the development of clear guidelines. Overall, AI-integrated educational strategies can substantially strengthen early childhood nutrition education when designed inclusively, age-appropriately, and interactively. Emphasizing innovative teaching practices combined with child-centered learning principles and ethical frameworks is essential to fostering healthier lifestyles and more meaningful educational experiences during this critical developmental period.

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