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Artificial Intelligence in Home Science: Transforming Family Resource Management and Human Development

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Abstract:

Artificial Intelligence (AI) is emerging as an important tool for improving household management, family well-being, education, nutrition, healthcare, and human development. Home Science, an interdisciplinary field concerned with family resource management, food and nutrition, human development, textiles, and community development, offers several opportunities for the application of AI-based technologies. Intelligent systems can support household budgeting, energy conservation, meal planning, nutritional assessment, personalised learning, child development monitoring, and care for older adults. These applications may improve decision-making, save time, promote efficient resource utilisation, and enhance the quality of family life. However, the adoption of AI also presents challenges related to privacy, algorithmic bias, affordability, digital literacy, and unequal access to technology.

Keywords: Artificial Intelligence (AI), Home, Food, Learning, Development.

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Introduction:

Artificial Intelligence refers to computational technologies that perform tasks commonly associated with human intelligence, including learning, pattern recognition, prediction, language processing, and decision support. Advances in machine learning, computer vision, natural language processing, and intelligent automation have expanded the potential use of AI in healthcare, education, household technologies, and social services. These developments offer opportunities to address practical challenges

associated with managing family resources and supporting individual development. Home Science integrates knowledge from nutrition, human development, family studies, resource management, clothing and textiles, and community education. Its primary objective is to improve the quality of life of individuals and families through scientific knowledge and practical skills. The integration of AI into this discipline can help translate complex information into useful recommendations for everyday living. According to Topol *et al*. (2019), collaboration between human expertise and AI can improve information processing and decision support in healthcare, although concerns regarding privacy, transparency, and bias remain important. Similarly, Zawacki-Richter *et al.* (2019) examined AI applications in higher education and highlighted the need to consider educational practice alongside technological innovation. In Home Science, AI may support decisions concerning household expenditure, food selection, nutrition, energy use, childcare, and educational planning. However, its value depends on the reliability of the technology, the quality of available information, and the needs of the families using it. Therefore, understanding both the opportunities and limitations of AI is essential for its responsible integration into family resource management and human development.

Applications of Artificial Intelligence in Home Science:

AI in Family Resource Management:

Family resource management involves the planning, allocation, and utilisation of money, time, energy, skills, and material resources to meet household needs. Effective management requires families to balance income, expenditure, responsibilities, and changing priorities. AI-enabled applications can assist in organising these activities by analysing spending patterns, categorising expenses, generating budgets, and identifying opportunities for savings. Intelligent financial tools can help users monitor household expenditure, plan savings, set financial goals, and receive alerts about recurring payments. Predictive systems may also help families estimate future expenses based on previous spending patterns. These tools can be particularly useful for households managing education costs, healthcare expenses, food budgets, and other essential requirements. Kufeoglu (2021) discussed the potential of AI-based home management systems to improve resource utilisation in areas such as energy, water, food, security, and household automation. Such systems illustrate how digital technologies can contribute to more coordinated household management. AI can also support time management by helping families organise daily schedules, coordinate household responsibilities, and plan activities. Nevertheless, recommendations generated by these systems should be adapted to local circumstances, household priorities, and individual preferences. Financial decisions involving debt, investments, or major expenditure should not rely exclusively on automated recommendations.

AI in Food and Nutrition:

Artificial intelligence (AI) has emerged as a transformative enabler in this context. Through advanced techniques such as machine learning (ML) and deep learning (DL), AI facilitates the extraction of actionable insights from complex health and dietary datasets (Sak and Suchodolska, 2021). Beyond personalized nutrition, AI contributes significantly to enhancing the food manufacturing process. Tools such as artificial neural networks and fuzzy logic models have been applied to optimize drying technologies, enabling manufacturers to better preserve nutritional content during processing. Advancements in DL, especially convolutional neural networks (CNNs), have

significantly enhanced the accuracy and efficiency of dietary assessment tools. These technologies automate tasks such as food image classification, portion size estimation, and nutrient content prediction, enabling more objective and scalable nutritional tracking. CNN-based models have consistently achieved classification accuracies above 85% across standard datasets. Dalakleidi *et al*. (2022) reviewed image-based food-recognition systems for dietary assessment and discussed their potential to support more convenient food-intake monitoring.

AI in Child Development and Family Relationships:

Human development encompasses physical, cognitive, emotional, social, and language development throughout life. Home Science professionals contribute to this process by supporting parents, caregivers, teachers, and communities in creating safe and stimulating environments for children. Research indicates that the disparities in socioeconomic status can result in diver gent cognitive outcomes due to differences in access to resources, early stimulation and learning opportunities, hence strong relationship exists between socioeconomic status and a child's health and academic achievement (Lee and Jackson, 2017). In today's digital age, the average time spent watching the screen has become a significant factor affecting cognitive development, with its impact varying based on the type of content and the length of exposure. Physical activities enhance physical and cognitive development during crucial development stages, while formal education is crucial for nurturing critical thinking and problem-solving skills.

AI in Health, Ageing, and Caregiving:

AI is increasingly being investigated for its ability to analyse health information, support clinical decisions, and assist with the monitoring of individuals who require care. Rajpurkar *et al.* (2022) described developments in medical AI, including advances in image analysis, decision support, and collaboration between humans and intelligent systems. Within family settings, AI-enabled devices may assist older adults and people requiring additional support through medication reminders, emergency alerts, activity monitoring, and voice-controlled assistance. Smart-home systems can detect certain unusual patterns and notify designated caregivers when further attention may be necessary. These applications may support independent living and help families coordinate caregiving responsibilities. Home Science professionals can contribute by educating families about safe home environments, personal hygiene, healthy ageing, caregiving routines, and appropriate technology use. AI-based health applications may also improve access to general health information and help users organise medical appointments or records. However, health-related AI has important limitations. Topol *et al.* (2019) and He *et al.* (2019) highlighted concerns associated with bias, privacy, transparency, interoperability, and safe implementation. AI-generated health information must therefore be treated cautiously, with clinical decisions remaining under appropriate professional supervision. Consent, dignity, personal choice, and the emotional needs of the person receiving care must remain central.

AI in Education and Skill Development:

Recent years have witnessed burgeoning changes in the development of learning pedagogy significantly enabled by information and communication technology. By providing an enriched environment, technology has created a profound influence on the learning experiences of individuals. Using technology, students attain a blended experience of in-class and outside classroom learning. With intelligent tutoring systems, technological architecture, and Artificial

Intelligence (AI) capabilities, new teaching and learning solutions are being developed and tested globally. Skills such as critical thinking, leadership, communication, and teamwork, are crucial as young minds are nurtured. Further, students have to be encouraged toward lifelong or continuous learning which will help them adapt to the changing work and life environment.

AI for Sustainable Living and Household Environment:

Sustainable household management involves reducing unnecessary consumption, conserving resources, managing waste, and making environmentally responsible choices. AI-enabled home systems can monitor electricity consumption, regulate heating or cooling, optimise lighting, and support more efficient appliance operation. Kufeoglu (2021) discussed intelligent home management approaches involving energy, water, food, and waste management. Such technologies may help households identify patterns of resource use and make informed adjustments to daily routines. Smart irrigation and water-monitoring systems can also support conservation where appropriate. AI may assist with waste segregation, recycling guidance, and purchasing decisions by providing information about product durability, packaging, and resource consumption. In combination with consumer education, these tools can encourage more responsible household practices.

AI in Clothing, Textiles, and Consumer Education:

Clothing and textiles form another important component of Home Science. AI can assist consumers in selecting appropriate garments, understanding fabric characteristics, planning clothing purchases, and managing wardrobes. Image-recognition technologies can support garment classification, while recommendation systems may suggest clothing based on size, preferences, weather, and intended use. In textile production and retail, AI can support quality inspection, demand forecasting, inventory management, and the identification of certain fabric defects. These applications may contribute to more efficient production and reduced material waste.

Role of Home Science Professionals in AI Integration:

Home Science professionals can help bridge the gap between technological innovation and practical family needs. Their interdisciplinary training enables them to evaluate AI applications in relation to nutrition, household economics, human development, consumer behaviour, and community well-being. First, educators can incorporate AI literacy into Home Science curricula, enabling students to understand the basic principles, benefits, and limitations of intelligent systems. Practical activities may include developing household budgets, comparing meal plans, analysing energy-use patterns, and evaluating the reliability of digital information. Second, extension professionals can introduce accessible AI tools through community workshops, demonstrations, and family education programmes. These initiatives should prioritise locally relevant applications and provide support in regional languages. Third, researchers can examine whether AI-assisted interventions produce measurable improvements in household expenditure, dietary quality, caregiving practices, resource conservation, and learning outcomes. Evaluation should include not only efficiency but also affordability, user satisfaction, cultural suitability, and unintended consequences. Finally, Home Science professionals should promote responsible technology use by teaching families to protect personal information, verify AI-generated advice,

recognise potential bias, and seek professional assistance when necessary.

Future Prospects:

The future integration of AI into Home Science will depend on the development of affordable, accessible, culturally appropriate, and evidence-based solutions. Research should move beyond demonstrating technical capability and investigate whether these technologies improve real-world family outcomes. Priority areas include multilingual AI assistants for household education, nutrition-support tools using regional food databases, intelligent budgeting systems for low-income households, and accessible caregiving technologies for older adults and persons with disabilities. AI-supported community platforms may also help disseminate information about sanitation, food safety, consumer rights, and family welfare services.

Conclusion:

Artificial Intelligence offers considerable opportunities to transform Home Science by improving family resource management, nutrition planning, education, caregiving, and sustainable household practices. Its applications may support informed decision-making, efficient resource utilisation, and improved access to practical knowledge. However, concerns relating to privacy, bias, affordability, digital literacy, and overdependence must be addressed through responsible implementation. Home Science professionals have an important role in evaluating these technologies and educating families about their appropriate use. Ultimately, AI should complement human expertise, empathy, and judgement rather than replace them. Its successful integration will depend on evidence-based applications that promote equitable, sustainable, and meaningful improvements in family life.

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